

**THE OPEN-AIR CLASSROOM – A PRELIMINARY
STUDY OF OUTDOOR CLASSROOMS FOR PRIMARY
SCHOOLS IN MALAYSIA**

By
Maheran Yaman

Submitted in fulfilment of the requirements of the degree of
Doctor of Philosophy

Schools of Architecture and Education

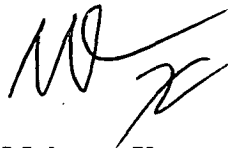
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Preface

A man with a book, a pool of shade and a circle of disciples. Sheikh Abd al-Raziq, sitting beneath an acacia and prodding the air with his much-thumbed manual of Islamic law, is the embodiment of orthodoxy. Around the old man his pupils crane forward – sitting in circle, listening and asking questions. The scene is archetypal. It is how Islam has been expounded to the people for over 1400 years. This is how the Prophet first expounded God's law for mankind, and the faithful still discover a new something of its original drama in its superbly appropriate setting. As an image of religious instruction its fundamental immediacy must be the envy of every reformer, be he Christian, Hindu, or whatever persuasion (Musallam, 1983).

The perception of teaching and learning in an environment directly connected with the surrounding natural environment attracted me as a landscape architect, to extend my research to the environmental conditions of primary schools in my home country of Malaysia.

I believe that the Prophet has taught us to be responsible to the natural environment around us, but we forget the essentials of his teachings in this respect, due to more recent colonial influences and economic rationalism. Therefore, I engaged in research to find out if there is an alternative to the current indoor restricted Malaysian primary school environment, in the hope that I could find an alternative, which more closely follows Islamic teachings about a responsible exchange between the natural and built environment in the context of a modern society.

The results of this research are not fully conclusive. However, I believe that I have developed an architectural/landscape architectural model of a school, which could improve thermal comfort and teaching and learning in Malaysian schools. I also have been assured by my research that the new school model may provide an economical and low energy use model of school buildings for the future.

I am aware, however, that all of my findings will need to be tested through a built pilot project, to verify their applicability to real life situations in Malaysia. This research indicates that the economic, environmental and pedagogical benefits of using such a model in the Malaysian context will be considerable.

Abstract

My research is based on the hypothesis that the increased use of outdoor classrooms in primary education in Malaysia could provide many benefits to Malaysian society. These include environmental, social and cost benefits, additional space for students, significant learning opportunities and improved thermal comfort in primary school buildings.

This research analyses and provides qualitative and quantitative data to inform the design of a prototypical model of structures achieving cost-effective solutions, while providing a significant improvement in perceived human comfort within schools. It was hypothesised that the cost-saving achieved by the use of such structures for outdoor classrooms could be used to improve the landscaping on school sites.

The research sought to explain, from an historical perspective, how the current situation with regard to the provision of school buildings in Malaysia has arisen and to develop appropriate recommendations for improvements based on Malaysia's culture, heritage and stakeholders' opinions. By means of a qualitative survey of opinions of building professional and teachers the research sought to establish if a need exists to improve teaching and learning spaces in Malaysian primary schools. The research also sought to establish to what extent contemporary educational theories have influenced Malaysian teachers' views about the educational needs of students and how these might best be achieved in relation to teaching and learning spaces in government funded Malaysian primary schools.

The research also aimed to ascertain the type of structures that might be suitable to improve the existing built infrastructure in fully funded Malaysian government primary schools. On the basis of costing studies, construction considerations, functional requirements and suitability to the Malaysian environment, it has been possible to develop a hypothetical model. Finally, suggestions for future research into primary school design based on the key assessment criteria detailed in this thesis are provided.

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I am indebted to many people in writing this thesis. My apologies are due if all their names are not mentioned.

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Glossary

<i>Almari</i>	cupboard (from Portuguese word)
<i>A priori</i>	a priority
<i>Baba and nyonya peranakan</i>	mixed marriage between the local Malays in Malacca and Chinese traders from mainland China
<i>Baju</i>	shirt (Malay)
<i>Bumiputra</i>	literally 'sons of the soil' - Malays and other indigenous peoples.
<i>Bahasa Melayu</i>	referred to in Malaysia as Bahasa Kebangsaan, the national language
<i>Cawan</i>	cups (Chinese)
<i>Cetis</i>	money lender from an Indian caste
<i>Escola</i>	(Portuguese)
<i>ESD</i>	Environmentally Sustainable Design
<i>Feringgi</i>	Portuguese
<i>Hablu min nan nas</i>	relationship between humankind
<i>Hablu min allah</i>	between humankind and the Creator
<i>Hablul min nal alamin</i>	humans and Creation-(the environment)
<i>Hadari</i>	sustainable
<i>Halaqah</i>	circle (seating in circle)
<i>Hijab</i>	headgear for Muslim ladies
<i>Hinayana and Mahayana</i>	famous Indian epic
<i>In vivo</i>	directly
<i>Jawi</i>	Malay written in Arabic characters
<i>Kaabah</i>	kiblat point in Mecca
<i>Kampong</i>	village (Malay)
<i>Kapitan Cina</i>	captain (Chinese)
<i>Kawi</i>	early Arabic written use for Malay manuscript
<i>Khalifah</i>	Vice-regent
<i>Kiblat</i>	Muslim prayers point to Mecca
<i>Koranic</i>	the holy book or scriptures send to Prophet Muhammad
<i>Kufia</i>	headgear for male Muslim
<i>Kurikulum Bersepadu Sekolah Rendah (KBSR)</i>	New Comprehensive Primary School Curriculum
<i>Kurikulum Bersepadu Sekolah Menengah (KBSM)</i>	New Comprehensive Secondary School Curriculum
<i>Iwan</i>	water channel
<i>Lebai / Tamil word labbai (written ilappai)</i>	
<i>Lepak</i>	relax
	pious man
<i>Madrasa</i>	religious Koranic school
<i>Mandur</i>	overseer (Portuguese)
<i>Masjid</i>	mosque
<i>Muafakat</i>	cooperation
<i>Mussulman</i>	Muslim man
<i>Panya</i>	wisdom is to learn to know oneself (Sanskrit)
<i>Pasantren</i>	Indonesia Islamic school
<i>Penghulu</i>	village elders
<i>Plearn</i>	to play and to learn equals to plearn (Kritikara, 2001)
<i>Pondok</i>	hut

<i>Pondok Tok Kenali</i>	Tok Kenali's school
<i>Ujian Pendidikan Sekolah Rendah (UPSR)</i>	Primary School Assessment Test (PSAT)
<i>Samanthi</i>	concentration (Sanskrit)
<i>Sila</i>	moral conduct (Sanskrit)
<i>Sanuk</i>	playful (Sanskrit)
<i>Sarong</i>	a length of cloth wrapped around the waist
<i>Sejarah Melayu</i>	Malay Annals
<i>Sekolah</i>	school
<i>Seperti Belanda diberi tanah</i>	translated as 'it's like giving land to a Dutchman'
<i>Sayang anak ditangan-tangankan</i>	spare the rod and spoil the child
<i>Songkok</i>	traditional Malay head gear
<i>SITC</i>	Sultan Idris Teaching College
<i>Sunna (sunni)</i>	following the prophet Muhammad do's
<i>Surau</i>	building smaller than mosque/ mussolla
<i>Rabbis</i>	Jewish religious teacher
<i>Ringgit</i>	Malaysian currency (RM)
<i>Rumi</i>	the Malay language in Latin characters
<i>Rukunegara</i>	national ideology
<i>Teko</i>	kettle (Chinese)
<i>Ustazs or ulamas</i>	pious or religious teacher in Islam
<i>Mo-Lo-Yu</i>	mentioned in the New History of the T'ang. Refers to the country of 'Malayu,' or Malaysia.
<i>Shih-li-fo-shoh</i>	This refers to the country of Srivijaya (Chinese)
<i>Madras schools</i>	education building system
<i>Raja Class</i>	Royal class
<i>Raja School</i>	Royal school
<i>Malay College, Kuala Kangsar (MCKK)</i>	Eton of the East
<i>Bab-ud-Darjat</i>	Gateway to High Rank
<i>UMS</i>	Unfederated Malay States
<i>PFS</i>	Penang Free School
<i>'3Rs' - Reading, Writing and Arithmetic Integration.</i>	This policy stresses the following important aspects of education: citizenship, national unity and moral development, living skills (manipulative skills, entrepreneurship and family life education), languages (communicative skills) and information technology

Keywords

Cost-effective

Cultural

Environmentally Sustainable Design (ESD)

Government funded primary school

Hot-humid tropical climate

Human comfort

Madrassa

Outdoor environment

Prototype

Stakeholder

Students

Teachers

Western pedagogy

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School gardens nature area
Natural water area
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Outdoor eating area
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(RM 450.00/m square = RM 45,000.
 (NB. The exchange rate is calculated at **RM 2.00 at AUD1.00**, current at the time of printing)

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Refereed Environmental, Education and Culture conference paper presented at University of Queensland held on the 1-5 July 2002 at Hawken Building, School of Arts and Media studies. Outdoor learning in the school grounds - A study of proposed additional outdoor classrooms for primary schools in Kuala Lumpur, Malaysia.

CHAPTER 1: INTRODUCTION

1.1 Overview of current education in Malaysia

The research is relevant to the intentions of the Malaysian Ministry of Education, expressed in the 2001 budget, to increase funds for education. The timing for the research into the physical environment in primary schools is appropriate, as towards the end of Prime Minister Mahathir's era, about 5.39 billion Malaysian *Ringgit* (AUD 2.7 billion), will be spent in 5,000 schools. A percentage of this funding will be used to construct 332 new primary schools and additionally, 330 million Malaysian *Ringgit* will be spent to upgrade conditions in existing schools (Mohamad, 2001).

As Malaysia is predominantly inhabited by Malay Muslims, Islamic teaching, with its environmentally related aspects, is an important part of the educational framework. This research suggests that the proposed increased use of outdoor classroom teaching is in accordance with original Islamic teaching ideas and methods, which have hitherto been neglected in favour of an emphasis on rote-learning of the Koran (Al-Quran) (Winstedt, 1950; Stevenson, 1975). For the purpose of this thesis, outdoor classrooms are defined as spaces which have a roof, adequate floor and semi-open side panels. The design layout of the classrooms includes: acoustics screens, earth forms and sufficient distance between each open classroom to reduce internal noise but maintain cross ventilation. For valuable items, security might also be provided by lockable storage within buildings or other outside locations (Yaman, 2002). In addition, outdoor classroom teaching based on the *madrassa* system, (for example, Pondok Tok Kenali), can provide improved thermal comfort without air-conditioning and a generally improved physical teaching and learning environment.

One of the fundamental concerns of education reforms in Malaysia is to develop teachers as reflective practitioners who will use research and enquiry as a basis for their professional development. However, it would not be correct to say this reflective practice was borrowed from the West. The practice of reflection and the

need to develop the mind through learning and systematic inquiry is the cornerstone of Islamic philosophy and forms the basis of the National Education Philosophy in Malaysia. Historically, Islamic teaching valued and explored humankind's relationship with the environment (Creation). Today there is considerable discussion about the importance of the environment in the Malaysian Education System, from the lower levels to the university level (Singham, 2003).

In reality, there is not much environmental input into education, not even in the existing courses offered in the Teacher Training Colleges. Dr. Othman Lebar (2000,) from Sultan Idris Teaching College (SITC) suggests that the situation in the education world in Malaysia seems like “a ship not anchoring at the port” {p.5}, meaning that the objectives of Islamic education have not yet been fully achieved. The Malaysian National Education System is designed to direct education as a whole and it is under the control of the Ministry of Education, which is responsible for managing a comprehensive school system ranging from primary to university level. This body regulates syllabi and controls national examinations. However, according to the Malaysian Minister of Education Dr. Musa Mohammad (2002), the objectives for education in Malaysia have not yet been fully achieved.

Throughout history, education theorists have often considered the importance of the needs of young people and their interaction with the physical environment. For example, Steiner developed a system, which considered the child's spiritual and emotional upbringing from an anthroposophical viewpoint which means that students voice should be the focus. One of the educational arguments that support reform in this area is derived from Robertson and Gerber's (2000) view that adults should listen to what children say. They suggest that children should have their own opinions about their education, instead of just learning what adults decide for them (Robertson and Gerber, 2000).

Although the present Malaysian education system is a product of many multi-cultural and ethnic influences, in general, it can be considered to be proscriptive and teacher-centred and as yet it has been little influenced by contemporary Western pedagogy (Ramli, 2002), as described in Chapter 3, Part A.

1.2 Research background

This research investigates whether there is a need to modify the physical limitations of the school environment in order to make it more comfortable and better suited to the users' educational needs and to incorporate the outdoor environment into educational programmes. Thus the main focus of the research is on the physical environment of primary schools, in particular in regard to the sustainability of the built environment in hot and humid tropical climates such as Malaysia. There are many reasons for improving the physical environment of schools in tropical environments, including: issues of human comfort, the creation of an improved educational environment and environmentally sustainable design issues.

It is evident that both teachers and students can perform their tasks better in a comfortable environment. Mechanical cooling will obviously improve the thermal comfort in hot and humid tropical climates. However, air conditioning of a whole school is expensive and has continuous maintenance problems. It also adds to the heat load on surrounding buildings (Keumala *et al.*, 1999).

According to Karyono (2002), the importance of environmentally sustainable energy usage involving state of the art technology is widely recognised. He suggests that the continuous consumption of non-renewable energy may contribute to environmental catastrophe, such as global warming. Therefore, environmentally sustainable designs for school buildings are imperative. In line with this belief, a key focus of this research is whether in hot and humid tropical climates, school environments can be improved without mechanical cooling.

The researcher's landscape architecture background led to a concern about school design and its relationship with the landscape (Yaman, 1999). Traditional classrooms without air conditioning in hot and humid tropical climates often create temperature zones on the edge of or beyond human comfort levels. Shaded outdoor areas with cross-air movement are believed to be closer to the climatic comfort zone. Also, it is argued that open-air but shaded classrooms could be feasible, both on educational and climatic grounds, leading to considerable savings of building costs. Educational outcomes may also be improved if school children can study in environmentally

more varied and perhaps intellectually more stimulating surroundings, compared to the standardised and often bland classrooms currently used in Malaysia. A mix of open and enclosed classrooms would also reduce the reliance on fossil energy for cooling for the operational life of the buildings.

In order to develop ideas for the potential improvement of the Malaysian primary school environment, the historical roots of the current education system and its physical school environment are investigated. An overview of the history of Malaysian society and the historical origins of its school education system was carried out at the outset of this study and is provided in the following section.

1.3 Malaysian history: An overview

In 2004 the Malaysian population consisted of more than 23.6 million people, of whom approximately 65.1% were *Bumiputra*, (literally 'sons of the soil', including Malays and other indigenous peoples). Peninsular Malaysia was originally inhabited by some 70,000 peoples of indigenous stock, including Negrito, Senoi, Jakun and Temelai (Rahman, 2004). The ethnic groups in Malaysia are Chinese, (26%), Indian, (7.7%) and others, (1.2%). Islam is the official religion and 60% were Muslims, with 19% Buddhists and smaller groups of Confucians or Taoists, (2.5%), Christians, (9%) and Hindus, (6%).

The official language is *Bahasa Melayu* (referred to in Malaysia as *Bahasa Kebangsaan* or the 'national language') and various Malay dialects are also spoken. The Chinese population speaks Hokkien, Cantonese and other Chinese languages and the Indian population speaks a variety of Dravidian and Indo-European languages, predominantly Tamil (Crean, 1996). The indigenous groups usually speak some Malay, in addition to their own tribal languages.

This ethnic diversity has resulted in the emergence of a pluralist society, which Furnival (1956, p.304), describes as "comprising two or more elements of social orders which live side by side, yet without mingling into one political unit." Current Malaysian society has been influenced by various foreign cultures. These include:

Indian, Chinese, Arabic, Javanese, Buginese, Acehnese, Cambodian, Thai, Portuguese, Dutch, British and Japanese.

The most sweeping religious change affecting the Malay Peninsula was the transition from Hinduism to Islam in the 15th century. Malaysia has a big history of foreign colonisation. The Malay Peninsula, in particular Malacca, was the major trading centre of Chinese naval trading missions and the staging post for Chinese overseas explorations until 1421, when China changed its policy towards the extension of overseas influence and trading (Johnston, 2003). Portuguese colonial influence began in 1511, followed by Dutch colonisation in 1641. The British presence in South East Asia dates back to the 17th century. In 1786 the British began trading as the British East India Company, based in Penang. They set up the Straits Settlement colonies of Penang, Malacca and Singapore after 1826. In 1914, the British colonial administration extended their territory to the whole of the Malay Peninsula (refer to Figures 1.1 and 1.2). Later trading activities led to the migration of labourers from China and India. Malaysia received independence from the British in 1957. In 1965, Singapore separated from the Federation of Malaysian states (Crean, 1996). The history of Malaysia is discussed further in Chapter 3, Part A.

1.4 An overview of the history of school education in Malaysia

The current education system in Malaysia was standardised by the administration in the 1950s, when Abdul Razak bin Hussein, (the head of the Education Committee in 1956), realised that the segregation of education during the British administration had divided West Malaysian society. In order for nationals of diverse ethnic origins to live in peace and harmony, the government wanted to create a common aim in education. The new educational policy became a part of the preparation for national independence in 1957 (Andaya and Leonard, 1982). However, the main features of 1950s British education were essentially retained in the formal curriculum. These included class time activities organised by the teacher in indoor classrooms only, where all lessons (except physical education) took place. Since the introduction of the National Curriculum by the Ministry of Education of Malaysia in 1957, the formal curriculum can also be regarded as being designed to achieve a set of

attainment targets, including the incorporation of environmental education (Singham, 2003).



Figure 1.1: Map showing the location of Malaysia (Hew, 1990, p.125)



Figure 1.2: Map showing the state boundaries in Malaysia (Hew, 1990, p.125)

1.5 Primary education

The National Primary education in Malaysia uses Malay as the language of instruction and covers the six years from Primary one to six. It aims to provide a good foundation for pupils in reading, writing and arithmetic. At the end of the six years, students sit for the 'Primary School Assessment Test' (PSAT) or *Ujian Pendidikan Sekolah Rendah* (UPSR), before entering secondary school. Irrespective of their performance in the PSAT, all primary school pupils are promoted to Form one, the foundation year of secondary education. Secondary education is a direct continuation of primary level education, but is ethnically segregated. The schools are divided into four types: National Primary School, Chinese National Primary School, Tamil National Primary School, Arabic National Primary Type School (Syed Zin, 2002).

1.6 Private education

In Malaysia, the establishment of private schools is governed mainly by the Education Act (1961). Private Education in Malaysia consists of the following categories: Pre-School Education, Private Primary Education, Regular Private Primary Educational Institutions, Chinese Private Primary Educational Institutions, Expatriate Private Primary Educational Institutions and International Schools. The current primary school grounds, which are usually quite generous in private schools, are used for an environment-related curriculum as well as to teach a range of formal curriculum subjects such as Physical Education, Language subjects (for example, English and Languages other than English) Mathematics, Science, Technology and Design, Information Technology, Geography, History, Religious Education, Drama, Art and Music based lessons (Syed Zin, 2002).

1.7 The government policy on education

It is the aim of the government of Malaysia to make primary education in Malaysia free for all citizens in the country. However, the philosophy of education in Malaysia is volatile, and tends to follow the latest education fashion, as other countries do. In the last ten years the National Curriculum has been modified several times to meet

the changing needs of the country. Among these changes are: the adaptation of the Primary School Curriculum Integration or *Kurikulum Bersepadu Sekolah Rendah* (KBSR), '3Rs' - Reading, Writing and Arithmetic, and the creation of both the 'Smart School' and the 'Visionary School'. This policy stresses: citizenship, national unity and moral development, living skills (manipulative skills, entrepreneurship and family life education), languages (communicative skills) and information technology. The Malaysian Education Policy gives complete authority to the Ministry of Education for the development of the National Education Policy, based on the 'National Ideology', which is commonly referred to as the *Rukunegara* and adheres to Malaysia's aspirations of unity and development (Singham, 2003).

However, the practice of the education system contradicts the objectives of *Rukunegara*, as it maintains separate cultural groups. Although, children at primary school, are taught in Bahasa Malaysia they speak their ethnic language at home, as well as learning their ethnic language as a subject at school. Furthermore, in Malaysia as outlined above, there are several types of primary and secondary schools, which are divided according to the ethnic languages of the pupils. All follow the National Curriculum and use the Malay Language prior to promotion to Secondary One, with *Bahasa Malaysia* as the medium of instruction. However, the Chinese or Tamil school students are required to spend a 'transition year' to enable them to adapt to the National Curriculum effectively (Singham, 2003).

1.8 Current primary education curriculum in Malaysia

The *Kurikulum Baru Sekolah Rendah* (KBSR) or the New Primary Schools Curriculum (the prototype primary school syllabus of government funded schools approved by the Ministry of Education in Malaysia) includes nine subjects from Primary one to Primary six, involving children from the age of seven to twelve. The compulsory subjects are: Languages, including Malay (the National language), English (as a second language) and other mother tongue languages, such as Chinese and Indian (including various dialects such as Cantonese, Hakka, Mandarin, Hokkien, Teo Chew, Telugu and Malayalam), Maths, Geography, History, Science, Religious studies, Life Skills, Arts and Drama, Music and Physical Education (Syed Zin, 2002).

1.8.1 The current education curriculum and the physical environment

Both the existing older school designs and the current primary school designs are largely based on English standard school design models of earlier eras. The functional planning of the more modern Malaysian schools (because of the British colonial influenced) still adheres to a model now outdated in the Western world. This teaching and learning model is highly structured and rigid. Additionally, the European origin of the architectural design of schools to suit a cool climate has created an inflexible physical environment in most Malaysian government primary schools. The building complexes usually demonstrate little regard for the tempering effects of shade and natural ventilation on climate, which is required in hot and humid tropical climates and successfully employed in most traditional Malay buildings. Thus tree planting is usually limited and unrelated to the buildings (Wan, 2000). Similarly, school buildings usually have very little connection to the surrounding landscape. For example, apart from sports fields the school site is usually paved with heat absorbing hard material (refer to Appendix A).

The current Malaysian school type has not been developed to mitigate the adverse effects of hot and humid tropical climates, but has evolved from European school design, modified by pragmatic and quasi-functional reasons. Nor is the current school design model related to historic Islamic schools with their shaded courtyards and open-fronted classrooms, opening onto the colonnaded courtyard perimeter (Hattstein and Delius, 2000).

1.9 Research design

The research is multifaceted, considering architectural and educational aspects of primary school education in Malaysia, which demands a dual design approach to fit the research context.

1.9.1 The Research context

- Malaysia has a hot and humid tropical climate, typified by high temperatures, high humidity and high rainfall for most of the year.

- Malaysian primary school design is based on the English school model, which is better suited to cold weather conditions and based on the Western monastic model.
- It will be demonstrated that schools based on Eastern design models such as the *madrassa*, incorporate elements such as external landscaping, open classrooms and vernacular traditions, which provide more productive and comfortable environments than the European school model in hot and humid tropical climates.
- Due to recent changes in educational policy in Malaysia, the construction and refurbishment of primary schools must be as cost-effective as possible, without impacting negatively on the health and comfort of students and teachers.

1.9.2 Research hypothesis

Increased use of outdoor teaching and learning spaces may contribute to improved school environments in the hot and humid tropical climate context of Malaysia.

1.9.3 Research aims

- To develop a series of Key Assessment Criteria, by which the appropriate design of Malaysian primary schools can be assessed.
- To develop a series of appropriate models on which to base the design of future Malaysian primary schools.

1.9.4 Research objectives

1. To undertake a literature review to provide background information in the following key research areas:
 - History and form of traditional English school models (Chapter 2).
 - History of Malaysian demography (Chapter 3, Part A).
 - History of non-European schools in Malaysia and in Oriental, Eastern and Western countries (Chapter 3, Part B).
 - Models for building for human comfort (Chapter 3, Part C).
2. Devise (from the literature review) and implement a questionnaire and in-depth interviews of a focus group.
3. Develop Key Assessment Criteria.

4. Propose a design model and test it against the Key Assessment Criteria derived from the data from the research questions.
5. Seek feedback from a Malaysian structural engineer and a quantity surveyor.
6. Modify the model following feedback.
7. Make recommendations for implementations of each aspect of the model in response to the research questions and the Key Assessment Criteria.

1.9.5 Key Assessment Criteria

The Key Assessment Criteria developed as an outcome of this research may form the basis for future research.

1.9.6 Research questions

The research revolved around the need to develop a more appropriate primary school model that considers Malaysian climatic conditions and Environmentally Sustainable Design (ESD) principles. This involved using external landscaping following the principles of existing non-European models (such as the *madrassa*), which offer cost-effective benefits to users (students and teachers), optimising health and comfort and improving learning outcomes.

The proposed improved physical environment should produce substantial financial savings compared to the current standard school building practice. The financial resources thus saved could be used to fund major improvements in the landscaping of school grounds. The improved, high quality school landscapes would both improve the human comfort conditions of the classroom structures and provide the conditions and environment for pupils to experience aesthetically rich and ecologically positive educational surroundings. The specific research questions investigated are:

Research question 1: What is the nature of current teaching and learning spaces in government funded primary schools in Malaysia?

Research question 2: How could alternative models of school learning and teaching spaces assist primary school environments in Malaysia?

1.9.7 Research method

The research seeks to develop an understanding of the background to the need for change in the Malaysian primary school system and to develop appropriate ideas and proposals to meet the perceived need for improvements to the standard Malaysian school environment. To clarify these points, an overview of the history and origins of the Malaysian education system is given, with reference to the dual influences of European and Koranic schools.

The literature review is then extended, to include an overview of the history of school architecture, including English and Koranic schools and their architecture, which have formed the basis of Malaysian school contemporary education. Theories in relation to outdoor education are investigated with reference to the present Malaysian school curriculum design, to determine their possible relevance to environmental education. A variety of hypothetical school models are developed to assess their perceived climatic, aesthetic and economic benefits, when compared to the fully enclosed standardised classroom buildings used at present.

The methods used in this research provide information which can be used to suggest improvements in design in primary school in Malaysia, as described below.

1.9.8 Research parameters

Malaysian primary schools have been selected as the focus of this research, because it seems practical to start at the earliest stage of compulsory education provided by the government of Malaysia. The research is based on initially my personal experience as a child attending a government funded primary school in Kuala Lumpur and working as an assistant architect in City Hall; later as a landscape architect in Putra Jaya Corporation (a new local government authority), and currently as a lecturer in the Department of Landscape Architecture, International Islamic University, Malaysia. This position enabled access to potential respondents. Care needed to be taken to monitor researcher bias, which might affect the research findings (Burns, 2000). Other factors considered in the selection rationale were data collection time factors and depth, which will be discussed under the heading: Development phases of the research method (refer to Chapter 4).

1.9.9 Investigative Issues

The Investigative Issues include an overview of ways in which Malaysian education incorporates and uses outdoor space. This information is interpreted against a background of the historic origins of and influences on the present Malaysian educational system and significant historic examples of outdoor teaching and learning both in Islamic and European educational history. This information is used to develop an external classroom space model for use in the Malaysian education system. A comparison is made between how architectural models incorporate outdoor spaces and the performance of traditional schools in Malaysia. This leads to the proposal for a new school model incorporating outdoor teaching and learning spaces which is applicable to standard Malaysian school sites.

Finally, stakeholder views are sought to ascertain current educational thinking and its relationship to teaching, learning and the natural environment. The data gathered are used to propose a design for improved outdoor classrooms spaces, which can be integrated into the physical environment of standard primary schools sites in Malaysia.

1.9.10 Thesis structure

Chapter 1 includes background research on the current state of Malaysian primary school design and gives an overview of education issues in the Malaysian context. This chapter also includes an overview of the research hypothesis, the research questions, the research aims, the research objectives, the research methods, the investigative issues and the parameters of the research.

Chapter 2 provides the research background, describing the context of the history and form of traditional English models, which have influenced Malaysian school architecture.

Chapter 3 includes a literature review of:

- The historical background of current Malaysian demography (Part A).
- The history of schools in Malaysia and in Oriental, Eastern and Western countries (Part B).
- A literature review for building for human comfort (Part C).

In the context of Malaysia's demographic heritage from pre-colonial, colonial and post-colonial periods, this section demonstrates the importance of Islamic beliefs to Malaysian educational philosophy. The description is based on official policy documents. The influence of recent Western pedagogies on education in Malaysia is described.

Part C shows how human comfort is catered for by school architecture in Malaysia at present. It presents a persuasive argument for the enhancement of learning, teaching and play through expanded use of outdoor spaces, which also incorporates the traditional links between people and their natural environments.

Chapter 4 describes the research method in three parts. First, a literature review of the multifaceted connections between education and architecture is undertaken. This led to the development of a questionnaire for stakeholder focus groups and an in-depth interview for educational stakeholders. This is conducted using model images as guided pictures (derived from the literature review) as an indicator of the intended outdoor teaching, learning and playing spaces. The questionnaire, focus group and in-depth group interviews are conducted for the purpose of validating the proposed architectural Study Model.

A primary school design model is developed from the questionnaire data and the literature review. This model is based on a comparison of present day Malaysian primary school buildings spaces with the *British A.J. Metric Standards* (Fairwater and Sliwa, 1972), the *European Standards* (Neufert, 1980) and the *Australian Commonwealth Standards* (Bower, 2003) for primary school spaces. The model was developed to show how the use of the outdoor environment could be incorporated, with the aim of improving human comfort during teaching, learning and play, on a hypothetical site in a Malaysian primary school, without mechanical cooling and with direct connection to the surrounding landscape. Finally, local professionals (a Malaysian structural engineer and a quantity surveyors) evaluate the models.

Chapter 4 discusses data collection and analysis methods and their relevance to the research, detailing the research questions and providing the Key Assessment

Criteria. The Key Assessment Criteria are based on the findings of the background research on the current state of Malaysian primary school design.

Chapter 5 discusses the findings of the questionnaire, in terms of the research questions and the Key Assessment Criteria. It describes the results of the quantitative and qualitative data gathering and provides a preliminary analysis of the data.

Chapter 6 proposes a model for primary schools in Malaysia and again tests each component against the research questions and the Key Assessment Criteria. The model is used to seek feedback from a Malaysian structural engineer and quantity surveyors. Later, the model is modified as a formalised model.

Chapter 7 makes recommendations for the implementation of each component of the model for future primary schools in Malaysia, discusses future research opportunities and provides a conclusion.

CHAPTER 2: SCHOOL SPACES AND THEIR EVOLUTION IN THE MALAYSIAN CONTEXT

2.1 Introduction

Until recently, educational ideas and practices in the Western world were based on classroom teaching developments that had been in use since the Middle Ages. These have persisted in Malaysian education and school architecture. However, during the early 20th century, new ideas were developing in education in Western countries.

As British schools have had the most enduring influence on the present Malaysian school environment, it is important to identify the origins of the philosophy of education, organisation and architectural forms of these schools. Accordingly, a brief overview of the history of Western education and its physical environment is given in this chapter, as this contributed significantly to the shape of British education and in turn, Malaysian education since colonisation by the British in the 17th century. Although the British influence on Malaysia's schools and their architecture has been strong, it is important to note that Malaysia has a rich and diverse cultural heritage from which to draw, including educational philosophy and building design. In particular, as a predominantly Muslim country, there is a rich tradition of Muslim thought and architecture, which this research argues, has been neglected during colonial and post-colonial times. However, the Muslim cultural heritage contains elements that are very much in agreement with modern Western pedagogical thinking and Environmentally Sustainable Design (ESD) concepts. Therefore, this chapter presents both an overview of the history of pre-British colonial schools in Malaysia and the history and theoretical background of traditional Malay Islamic schools.

In this Chapter, the origins of traditional European education are also briefly discussed, with reference to the historic development of monastic education and its influence on school architecture in Britain and subsequently, in Malaysia.

A discussion of the development of Islamic architecture, in particular the development of the *madrasa* (in conjunction with the mosque), is given, in order to show the influences on traditional Malay Islamic schools, in comparison with Islamic architecture elsewhere. It is postulated that this discussion may provide relevant cultural perspectives on teaching and architecture, to inform possible future culturally sensitive school design solutions for Malaysian schools and to support the validity of the use of outdoor classrooms in the Malaysian cultural context.

2.2 Classical to mediaeval period

The extant literature concerning the development of the Western school contains numerous references to open-air education in the past. For example: Diogenes (from 341 BC to 270 BC) (in de Botton, 2004) and the Epicureans (from 306 BC to 270 BC) conducted classes in a natural setting. Although little physical evidence remains of pre-mediaeval schools, Greek and Roman classical writings mentioned schoolrooms where the didactic was a group of students reading, writing and learning classical oratory outdoors. Whereas educated tutors at home often taught wealthier students, higher learning often followed the model of Plato's Academy (from 387 BC to 529 AD). Richardson (2000) notes that Plato's Academy involved master and pupil setting off on walks to discuss "plants and wildlife, mathematics and politics" (p.364). It is believed that Plato also had a private garden (the Academy) in which he taught philosophy and scientific research. According to Richardson, Plato considered the Academy to be "his lifetime's achievement, greater than any of his writings" (p.364 - refer to Figure 2.1).



Figure 2.1: An imaginary mosaic illustration of 'The Academy' (Richardson, 2000, p.364)

During the same period in Europe, the mediaeval Christian garden emphasised “geometry and containment” and the “taming of the wilderness” (van Zuylen, 1995, p.38) as did monastic education. Education in the monasteries was ascetic and inward looking and most educated persons were clerics who gained their education within the confined, protective and restrictive walls of the monastery. Early Christian teaching gave little regard to the untamed natural world and to earthly life, as rewards were obtained in the “afterlife” only (p.38). Although gardens and scientific study were important elements of monastic education, earthly life and the physical world were considered a distraction from pious thinking and monastic life.

The layout of the monastic school and buildings were reflected in later European school design. Indeed, some of the monastic buildings were adapted and reused as schools in later times (for example, Winchester Cathedral School and Eton school, described in Hunter-Blair, 2004), which will be described further in the section the development of the English school. Monastic architecture had a long-lasting effect on the design of schools and colleges in Europe and European colonies elsewhere, including Malaysia. For example, monastic architecture influenced the schools introduced by the Portuguese in Malacca during their occupation of Malaysia. This is discussed further in Chapter 3, Section A.

2.3 The change of teaching spaces from indoor to outdoor

After the fall of the Roman Empire in the late 5th century, political unrest in Europe led to the restriction of teaching to the monasteries. The natural world represented in the gardens of the European monastery (and the Muslim equivalent the *madrassa*, similarly situated in the mosque complex) was used as a source of contemplation and scientific study. The garden was also used as a tool of research and teaching, as van Zuylen (1995,) points out,

...during the Middle Ages, monasteries played a pivotal role in preserving the arts and sciences, including kitchen and physic-or medicinal-gardening skills. Their libraries were repositories of classical garden literature (p.33).

The later botanic gardens of the Renaissance were inspired by Mediaeval physic gardens which according to van Zuylen (1995) were

...rooted in Islamic learning [and] founded by Arab physicians from Spain. For example, the renowned medical school at Montpellier had a physic garden around 1250. (p.37)

Gardens in the Islamic tradition first appeared in Europe in the 8th century, when the Arabs conquered large areas of Spain. The Muslims preserved the ancient Greek botanical texts and translated them from 830 BC onwards. However, Christians and Muslims saw nature from somewhat different perspectives: monastic schools and gardens in the Judaeo-Christian tradition were generally seen as “morally edited space, as in the garden of Eden” (Richardson, 2000, p.234).

According to van Zuylen (1995),

Monks cultivated subsistence gardens with their own hands and by the sweat of their own brows. Their genuine feeling for nature was nurtured by their traditional belief in the biblical Garden of Eden. Tending these earthly equivalents of paradise lost – and promised – provided food for the soul as well as the body (p.33).

The Islamic tradition saw garden design as a reflection of Creation and a source of pleasure. Van Zuylen states, “the pervasive presence of ... water signifies its importance as a symbol of life in Islamic culture.” (p.38). Therefore, the Mediaeval Christian garden was seen as a biblical allegory, whereas Islamic gardens were seen as an earthly paradise.

The Arabs were early exponents of environmentally sensitive design, channelling water to modify their courtyard sanctuaries, to create comfortable surroundings in which to make their religious ablutions, contemplate and study. This was exemplified in the 11th century Madrasa Al-Firdaus ,which:

... combines a legal school as well as mausoleums and monastery in one complex. The courtyard measures approximately 55x45 metres, with a triple domed mosque flanked by two mausoleums on its southern side. The halls along the eastern and western sides were probably used for teaching and meetings. Passages lead through past the iwan (water channel) on the northern side to separate residential wings. There was originally a garden in the north of the madrasa with a second iwan opening off it...the rectangular courtyard of this elegant complex is flanked on three sides by arcades ... a wide iwan opens out off the northern side of the courtyard. The octagonal pool with cloverleaf inner walls in the middle of the courtyard is typical (Hattstein and Delius, 2000, p.179).

2.4 Islamic architecture and the development of the *madrasa*



Figure 2.2: (Right) The Madrasa al-Firdaus in Aleppo and the Courtyard (Left)

In the 11th century, during the mediaeval period in Aleppo known as ‘the Ayyubid Golden Age’ many schools were built (p.177). These produced an architectural

prototype for future Islamic school architecture. For example, the Al-Agami family in the city founded three schools:

Parts of their palace have survived, including a courtyard with an octagonal fountain surrounded by four iwans. Ghazi's wife ... was responsible for the most famous legal school in Aleppo, the *Madrassa al-Firdaus* (School of Paradise). This *madrassa*, which was used simultaneously as a mosque, mausoleum and Sufi monastery, is laid out around a courtyard with an octagonal fountain flanked on three sides by arcades. On the northern sides there is a wide iwan, behind which the living quarters of the students are located... there was originally a garden in the north of the *madrassa* with a second iwan opening of it (Hattstein and Delius, 2000, p.178-179).

During the 13th, the Merinids, (who conquered present day Morocco and established a dynasty), founded numerous *madrassa*, including the Misbahiya built near the Qarawiyyin mosque in 1346. This *madrassa* "was used as a hostel by the students of the University of Fez until the mid 20th century and is still in use today" (Hattstein and Delius, 2000, p.312). The design of the *madrassa* reflected the political system of the time. During the Seljuk period in Turkey the *madrassa* was an important tool in the reorganisation of the political system which was molded to fit the government's religious policy. During the 15th century, Nizam (the emperor of Seljuk and one of the political architects of early Islam) developed a political state based on *sunna* law. The instruments of this form of political control were the *madrassa*, which were not simply Koranic schools, but universities for the future juristic and administrative elites, and to this end they tied religion and state together from day one. These *madrassa* "provided the model for all later *madrassa*" (p.350).

Theology, jurisprudence, languages, literature, the natural sciences and political science were all taught in the *madrassa*. This was a major change in Islamic education, as previously the most important place of learning was the mosque or the Koranic school. The power of the *madrassa*, was further reinforced by students' dependence on government funding as:

...the students, ... needed approval from the state in order to study ... [their] upkeep was paid for by a monthly stipend from the government, all had their own rooms and attended lectures delivered from a chair or lectern by professors dressed in gown and turban (Hattstein and Delius, 2000, p.350).

According to Hattstein and Delius the Central Asian type of *madrasa* came into being at the beginning of the 15th century and as several of these *madrasa* survived, it is still possible to observe the design, which influenced later *madrasa* in Malaysia and elsewhere:

The three oldest surviving madrasas in Central Asia date back to this period... These madrasas were theological colleges in which the material sciences, including mathematics and astronomy ..., were also taught. All three of the Ulugh Beg Madrasas in Bukhara (1418), Samarqand (1417 to 1420), and Gishduwan (1437) were built using the same schema, for the arrangement of space seen in the Bu Inaniya *madrasa* (Hattstein and Delius, 2000, p.518).

The following quotation was found inscribed on the carved door of the Bukhara *madrasa* and (according to legend) referred to a ruling by Ulugh Beg “To strive for knowledge is the duty of each and every Muslim man and woman” (Hattstein and Delius, 2000, p.518). This inscription reflects the importance placed on education in Islamic societies such as Malaysia, as discussed further in Chapter 3, Section B: Present Malaysian educational ideas.

2.4.1 *Madrasa* in present day Malaysia

The design of the traditional *madrasa* is used in mosques and universities in present day Malaysia, but not in primary or high schools as government schools have preferred the 19th century British model. It seems to be self-evident that many traditional elements of the *madrasa* could be adapted for use in government schools without the religious connotations. For example, the building approach could include and s,culturally climatically appropriate design interventions, such as: the development of the ‘*halaqah*’ which refers to group study sitting in a circle and also reflects the Islamic practice of circling ‘*kaabah*’ in Mecca; use of the ‘*kiblat*’ or point of prayers for all Muslims, to provide a focus of activity within the school; sensitivity regarding the design of toilets not to face the ‘*kiblat*’ point; use of local building materials following local tropical architecture forms of buildings and roof designs. Also spaces should be flexible to allow for gathering during Malay Muslim festivals, to permit communal activities. Examples of these culturally specific design interventions can be found the International Islamic University Malaysia (Zen, 1997). Design features such as *iwans* (courtyards with colonnades and classrooms facing into a courtyard with water and vegetation) could be used to improve human

comfort in the tropical, hot and humid climate of Malaysia, as vernacular architecture has for many centuries in other hot Islamic countries (Afshar, 1970, pp.29-44) (refer to Appendix B, Figure B1).

2.5 The development of the English school

The oldest surviving mediaeval schools in England, such as Winchester College built in 1382 and Eton, built in 1440, clearly show the influence of monastic architecture and planning on the newly emerging colleges of the 14th and 15th centuries (Cookson, 2004). According to Seaborne (1971 p.2) “these colleges with their tightly-organised structure, reflected a reaction against the often ill-disciplined and undifferentiated character of earlier schooling”.

Remaining evidence of the large schoolrooms shows a highly organised layout with fixed benches (Seaborne, 1971). After the dissolution of the monasteries by Henry VIII, former monastic buildings were converted to school use, for example at Canterbury, Chester and Gloucester. Schools in England remained strongly disciplinarian and it is interesting to note that almost all school seals from the 16th century to the 18th century show the teacher or headmaster holding a birch rod (refer to Appendix B, Figure B2, Seaborne, 1971).

School building design began to diverge from its monastic origins from the 16th century onwards. However, the spatial and hierarchical influence of the monastery can still be traced in these buildings up to the 18th century (Keyes, 2003).

Flogging and other forms of punishment remained universal in the school system and caused major rebellions at the end of the 18th century at Eton (Seaborne, 1971). attitude towards punishment is echoed in the saying, ‘spare the rod and spoil the child’ and is reflected in Malay Islamic education by the phrase, ‘sayang anak ditangan-tangankan’, ‘pity the child who is never struck.

Larger English schools mostly retained the cloister type of open quadrant as the basic plan. The large, open but often partitioned dormitories can be related to both the monastic common dormitories and the mediaeval halls. Smaller schools were

simpler, often built with a Georgian façade and planned with a large schoolroom and a master's house attached, which included accommodation for boarders (refer to Appendix B, Figure B3, Seaborne, 1971).

Towards the end of the 18th century, (the age of Enlightenment) the original and restricted Classics-based grammar school curriculum began to change and many schools introduced science, geography and mathematics into their curriculum (Seaborne, 1971).

The emergence of the smaller non-conformist religious schools helped to change both the curriculum and the architectural language and planning of the new schools. The Kingswood school, founded near Bristol in 1786 by John Wesley, is an example of this. The curriculum included reading, writing, arithmetic, English, French, Latin, Greek, Hebrew, history, geography, chronology, rhetoric, logic, ethics, geometry, algebra, physics and music (Seaborne, 1971). Gardening was encouraged and individual small garden plots were provided in the grounds (refer to Appendix B, Figure B4).

The new school buildings were much more compact than the monastic buildings which influenced earlier schools. A number of new, smaller schools opened during this period, often being converted from existing, older buildings. A number of charity schools were also built to educate the poor. These schools abandoned the cloister type design and were mostly built in a compact two to three storey style (refer to Appendix B, Figures B5 and B6). During this period, all over England, most schools became known as 'comprehensive schools'. These schools form the major influence on many present day Malaysian schools (refer to Figures 2.3 to 2.5). The layout of each classroom in these schools is basically square, with rows of seats or chairs to fit up to forty students, with a blackboard in front and a teacher's seat and table in the corner.

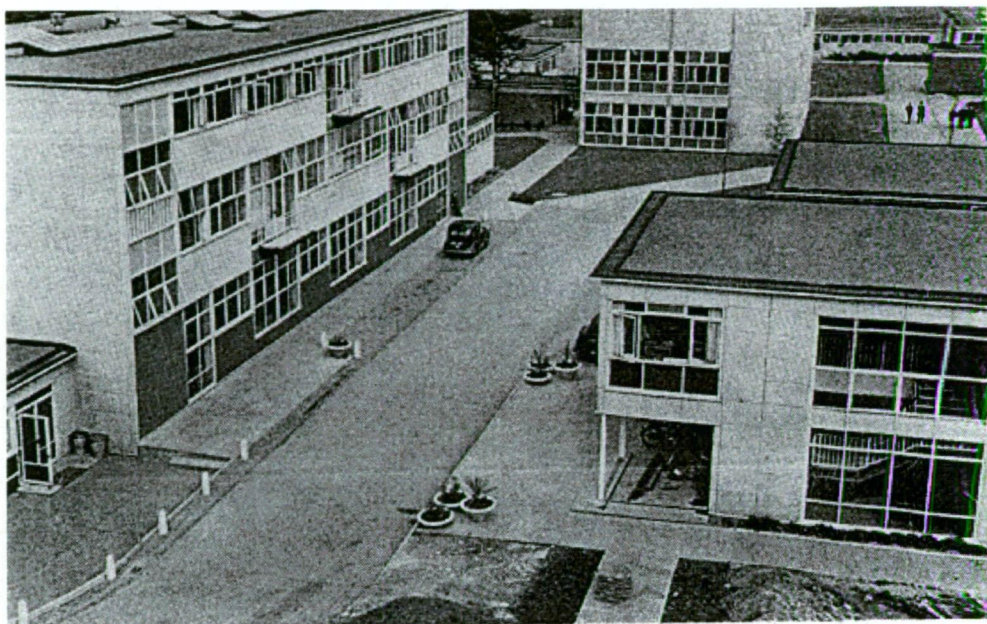


Figure 2.3: Woodlands Comprehensive School, Coventry, 1956 (Seaborne and Lowe, 1977)



Figure 2.4: A typical modern Malaysian primary school

In the early 1800s, Joseph Lancaster's 'model' schools entered the British educational scene. The Lancastrian model plan advocated enormous schoolrooms of (21.3 x 9.8 metres) containing twenty rows of desks for 320 pupils, facing the master's platform (0.65 square metres space for each pupil). The level of the floor was to be raised slightly towards the back (refer to Figures 2.5 to 2.6). Lancaster's model also recommended ducted warm air heating (Seaborne, 1971).

Architect Andrew Bell developed a similar but slightly less rigid system of classrooms for primary school education called 'the Madras school' in Madras, India. The 'Madras school' was an inheritance from the British colonial era influenced by the ideas of Joseph Lancaster. Although school architecture in England changed during and following the 1960s, pedagogy and classroom design in Malaysia has remained frozen as it was at the end of the colonial period (Stanfield, 2004).

The 'Madras school' was implemented at the Central School in London with even larger student numbers in one classroom (600 boys and 400 girls). Much of the teaching and learning was carried out with students standing (refer to Figure 2.6).

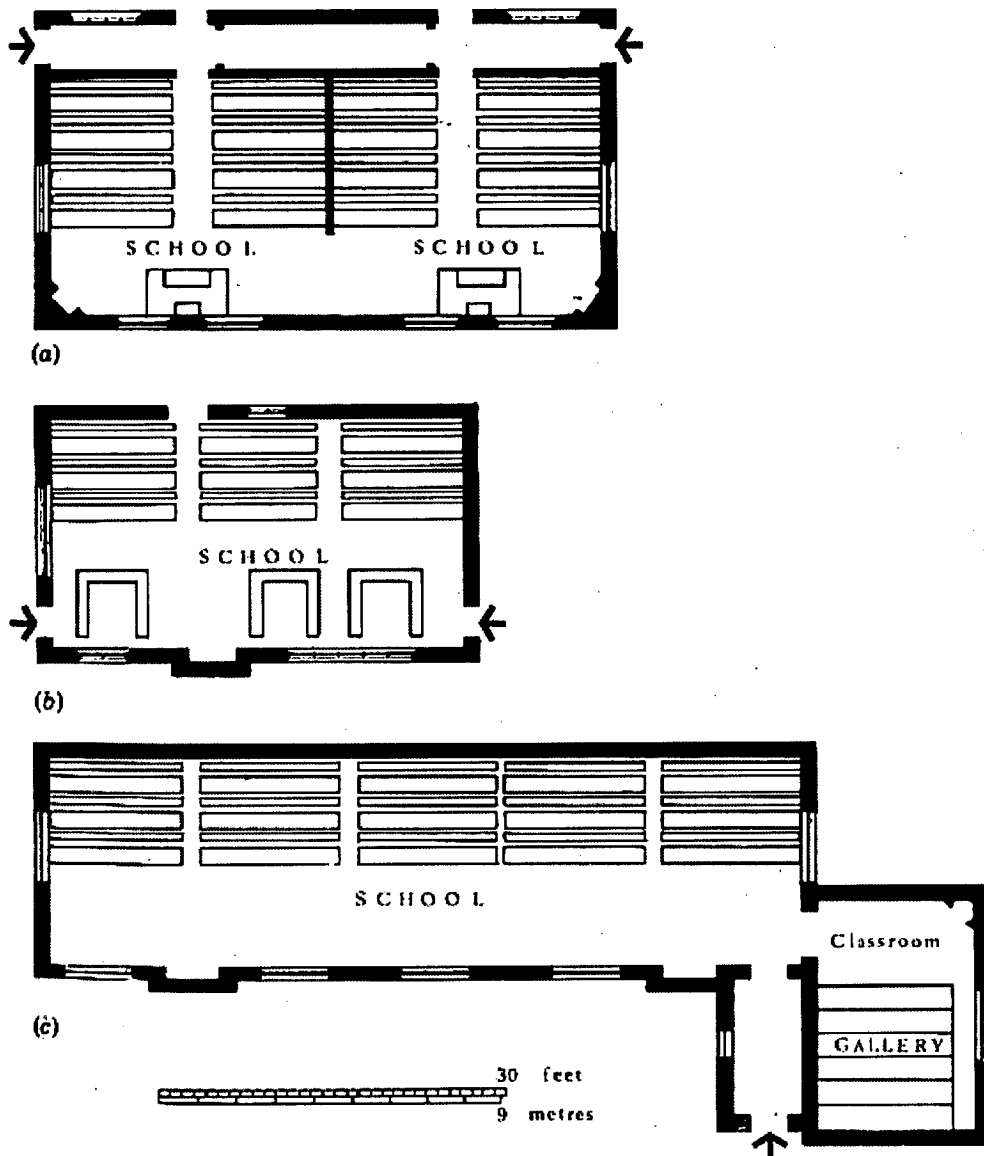


Figure 2.5: Examples of other types of classrooms design issued by the English Committee of the Council on Education: a) Plan for 112 children; b) Plan for 116 children; and c) Plan for 120 children (Seaborne, 1971, p.201)

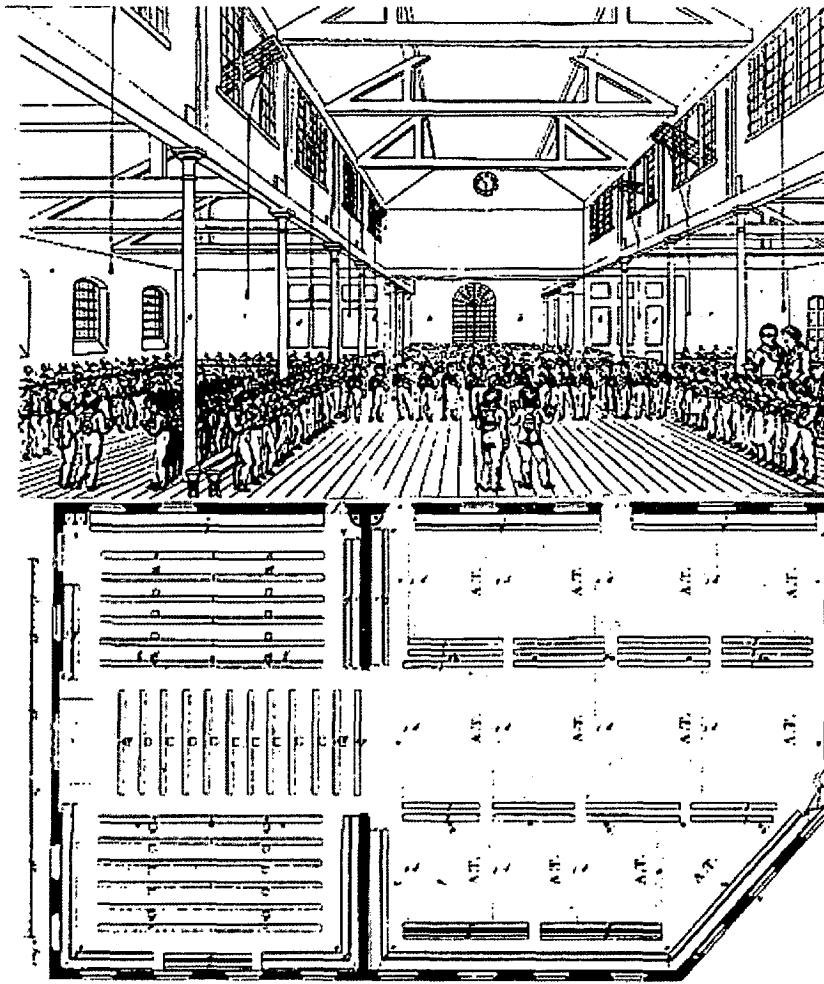


Figure 2.6: Central School of the National Society, Baldwin's Gardens, London, 19th century, an example of Dr. Andrew Bell's Madras School, applied in Penang Free School, 1816, Malaysia (Seaborne, 1971)

2.6 Open-air learning experiments in England

According to Seaborne and Lowe (1977), due to limited finance during the Second World War in England, there were attempts to create open-air pavilion type schools for use during summer. They were built and organised mainly for health reasons - to provide fresh air and sunshine for urban children who often lived in appalling conditions. Construction was cheap and practical and would be suitable for tropical climates (Hansen and Hansen, 2002) (refer to Figures 2.7 to 2.8).



Figure 2.7: Pelham's open-air school during the rest period in summer (1909) (Seaborne and Lowe, 1977)



Figure 2.8: The open-air pavilion type school at Sheffield (1911) in summer, (Seaborne and Lowe, 1977)

The interior design of Malay schools during the British colonial period (from the early 19th century to 1957), was based on the attitudes to education implicit in the design of cloistered monasteries. Obedience and fear towards teachers was inculcated by flogging and corporal punishment, as the main forms of discipline. This was continued in the 'Lancastrian monitoring system' where learning and teaching were mainly based on rote-learning (memorising) and older students were selected to teach younger ones. Classroom space remained square, with students standing or (later on) sitting in rows, which produced a sterile regimented response to learning (Seaborne, 1971). This changed little until new subjects were introduced to the curriculum and more emphasis was placed on new exploratory teaching and learning methods.

As buildings were designed with increased student capacity, with a limited number of teachers, they began to change and expand. During the 20th century, teaching became somewhat more relaxed in comparison with the Lancastrian system.

2.7 Conclusion

Historically there have been examples of successful schools incorporating outdoor teaching spaces, such as Plato's Academy, the Epicurean schools, Diogenes schools, early monastic schools and Islamic Koranic schools or *madrasa*, all of which used the environment as a stimulating teaching space and learning resource. The development of the *madrasa*, in association with the mosque (*masjid*), is remarkably similar to the evolution of the monastic school the influence of which on British School design is discussed. The influence of British colonial school architecture in Malaysia is demonstrated (refer to Figures 2.3 and 2.4). During the Second World War when the budget was limited, the British developed a simple structural approach to the design of school buildings for use in the British summer. Malaysian pedagogy and school architecture should reflect the best current ideas in the global arena (Nair, 2001). Accordingly, some of these ideas are examined, as they appear relevant to the Malay context. In terms of educational spaces, various philosophies have traditionally dictated the shape and arrangement of the space.

Malaysia is a predominantly Muslim country and therefore it is significant to the Malaysian context that traditional Islamic teaching from the time of the Prophet incorporated outdoor space in building design (similar to the early Greek and mediaeval monastic schools in Europe).

The narrow interpretation of education, which had developed in Britain by the 17th century, disregarded the importance of the impact of outdoor elements to earlier approaches to education. Additionally, because of the impact of British colonisation, the pedagogy and architecture of government funded primary schools in Malaysia did not evolve in its own context,, but still follows the regimented early British colonial plan.

The 'Madras school', was an inheritance from the British colonial era, designed by architect Andrew Bell and influenced by the ideas of Joseph Lancaster. Although school architecture in England changed during the 1960s and in the following period, pedagogy in Malaysia did not develop further. However, there have been minor changes in Malaysian school architecture. For example, one difference between the English contemporary school and the typical Malaysian school is the increased use of open corridors and an open ground floor, to accommodate airflow in the tropical climate (refer to Figure 2.4). Although the 1911 open-air pavilion type school in Sheffield (designed for the use of underprivileged children during the summer holidays), is suitable for the Malaysian climate as it allows cross ventilation, it was not adopted in Malaysia (refer to Figures 2.7 to 2.8).

This chapter provides a background to Malaysia's cultural heritage and the pre-colonial history of Malaya. The extant literature is discussed with reference to Malay, Chinese, Hindu and Islamic influences on education and architecture in Malaysia. Following this, the literature concerning the colonial history of Malaysian schooling is described in more detail. An overview of the development of schools in Malaysia, from the pre-colonial period to the present is given, with particular emphasis on the influence of regional architecture and religious traditions in education.

Chapter 3 describes the British Education system and how its pedagogy and architecture has changed under the influence of educational philosophers.

CHAPTER 3: THE CONTEXT OF CURRENT MALAYSIAN SCHOOLING

3.0 Introduction

The previous Chapter outlined the heritage and the rich history of Malaysian education. This chapter suggests that there is a need for change in the Malaysian education system to reflect this history. Thomas and Keats (2000) suggest that within the multicultural society of Malaysia with its varied religions, languages and traditions, Malaysian teachers need to be trained to implement a curriculum that recognises multicultural diversity, to unite the various cultural groups. Although the National Policy states that the language of instruction is *Bahasa Malaysia*, because of the existence of a variety of community languages spoken by the ethnic minorities in Malaysia, all teachers are faced with the needs reconcile cultural differences (p.19). The problems that arise should not be taken as weaknesses or threats, but as opportunities to develop teaching tools. This is now stimulating a renewed interest in the role of nature and the environment in educational settings such as primary schools.

The relevant literature providing the background to this focus is examined in three Parts, as follows:

In Part A, an overview of the development of pre-colonial formal education in Malaysia is provided, from early Malaysian settlement to the Hindu and Islamic influences during the 13th to the 15th century. The influence of Chinese traders and immigrants from the 7th century onwards, as described in the literature, is discussed, followed by a brief overview of European pre-British colonial schooling in Malaysia and the early British schools in the Straits Settlements. Part A also reviews the history of British influence on Malay education to trace the origins of the still prevailing present day Malaysian school architecture and educational ideas.

Part B links a historical overview of the development of Malaysian schooling, with the current approach to education and architecture in Malaysian primary schools.

International awareness of the importance of environmental education at the global level is compared with current Malaysian teaching philosophy and practices. Part B also briefly outlines current global ideas about teaching and learning. In order to understand the interaction between histories, traditional practice and new ideas in education, the development of Western pedagogy, in recent times and across cultures is considered. Malaysian education (in a 21st century global context), is the key focus of this research. To understand this context, key elements of the development of Western educational theory in the 20th century are summarised. Accordingly, this section discusses the re-thinking of education in the 20th century by the major educational theorists whose work has influenced current Western pedagogy. In addition, some traditional concepts of the Eastern cultures represented in Malaysia, regarding education and its physical environments are discussed. Traditional non-Western concepts of education, which have influenced Malay culture (such as Buddhist and Islamic traditions), are compared with current Western views in this field.

In Part, B literature relevant to the psychology of learning and detailing the influence of landscape and building design on children's learning development is reviewed (Robertson, 1993; Kong, 2000; Holloway and Valentine 2000; Jones, 2000; Fielding, 2000; Gagen, 2000). The work of these researchers helps point the way towards the development of a theoretical framework, which can promote changes in existing school design based on psychological and sociological research perspectives in addition to pedagogical perspectives. This overview provides an understanding of the influence of spatial design and landscape, on children's development.

Part C reviews the literature regarding human comfort in tropical, hot and humid climates. Part C also investigates techniques of building which improve school conditions and which are energy and efficient in their use of materials. These includes:

- Landscaping, especially vegetation arrangement and selection.
- building orientation and prevailing wind connection.
- application of regional building materials.

Part A

3.1 An overview of early Malaysian settlement

The majority of the present Malaysian population were immigrants from pluralist societies, during various historic periods. They displaced the indigenous people in the fertile areas and forced them back into the deep jungle (Winstedt, 1948; Wilson, 1967). At this earlier and undated period, the purpose of education is assumed to have been as preparation to survive and to aid people, to live in harmony with nature (Winstedt, 1948). Heine-Geldern and Callenfels (in Winstedt, 1948) date the Malay migration from Asia at between 2500 and 1500 BC. The Malays had become, by the present era, the largest Malaysian ethnic group, followed by the later immigrant Chinese, Indians and others. Malay tradition records the first settlement of the Peninsula as occurring in Palembang in Sumatra. According to Cox (2000), the original Malays spread to Sumatra and Borneo and formed the Minangkabau peoples in Sumatra: a distinctive, matrilineal isolated cultural group. The Iban and some Malay-Dayaks, who are also included in this coastal Malay group, arrived in Borneo before the spread of Islam in South East Asia. It appears that Kedah was the first Malay-settled kingdom in Malaysia (Winstedt, 1950).

Malay society is extremely complex, due to Malaysia's geography and its multicultural origins. Nicholas and Soong (1998) state that in certain parts of Malaysia, the ability to speak Bahasa Malaysia in addition to the mother tongue is still uncommon. The indigenous peoples and their advocates accuse the national government of taking a regressive step when it signed into law the 1996 Education Act. Under this law, the right to learn one's ethnic language, national language, mother tongue or indigenous language, does not exist. Therefore, there has been popular support for the Malaysian government to amend the Education Act of 1996, to reflect the National Education Policy as originally stated in the Education Ordinance (1957), ensuring the use, teaching and development of the mother tongues of Malaysian ethnic communities (Nicholas and Soong, 1998). Similarly, the Education Act does not include environmental education, which is particularly significant from the viewpoint of indigenous traditions.

3.1.1 Hindu influence in the 14th and 15th century

The Indian civilisation of Southeast Asia was the civilisation of an elite and not that of the whole population and the elite beliefs and way of life are still not well-documented. The development of Indianisation occurred right up until the Majapahit Empire, centred in Java, which ranged from Rajasa (1222 to 1227) to Bhre Tumapel (1447 to 1451) (Cox, 2000). Winstedt (1950) notes that inscriptions prove the presence of *Hinayana* and *Mahayana* Buddhists in 4th century Kedah. Hindu Majapahit also influenced states such as Perak, Pattani and Kelantan in the early 14th century. Little is known of the education system and methods of the Hindu era, as the earliest manuscripts of the Malay-Hindu period are from the 14th century, written in a Perso-Arabic alphabet. However, it can be assumed that a small literate class of scribes was educated in this period, as a number of Indian epics were translated into Javanese and Malay and the copies of these were produced in *Kawi* script before 1400 (Winstedt, 1950, p.139). The Javanese cycle of Panji tales were translated into Malay in mediaeval Malacca, in Kelantan, when knowledge of *Sanskrit* and the *Kawi* script had waned, at the end of the 14th century (p.142). It is reasonable to assume that until the 14th century and during the earlier 15th century, the Peninsula of Malacca consisted of a number of separate Hindu or Buddhist kingdoms with strong connections with Sumatra and Java (Winstedt, 1948; Bastin and Winks, 1966).

Achehnese, Bausani and Javanese literature all show links with Hindu culture (Cox, 2000) and the oldest existing Indian community in Malacca is the *Cetis*, who are descended from a money-lending caste in India. At its peak around 1450, the Malay Sultanate stretched from Kedah in the north to the Riau islands in the south and included several territories on Sumatra. Malacca was linked by trade with the Mediterranean and Europe; with the Middle East (via Gujerat and the Red Sea ports); with India and with most parts of Southeast Asia and China (Kheng, 1998). The Indian population increased in the four main Sultanates of the Malay Peninsula (namely Selangor, Perak, Pahang and Negeri Sembilan), otherwise known as the Federated Malay States (FMS), by almost twenty fold, from 20,000 in 1891 to 380,000 in 1931 (Smith, 1952).

3.1.2 Early Islamic influence from 13th to 15th century

By 1281, Islam had made some progress in Sumatra at Malayu (Malaysia), as the Chinese sent the Muslims Sulaiman and Chamsuddin to Malayu as emissaries (Cox, 2000). Marco Polo described the inhabitants in Perlak in the north of Sumatra as idolators who, due to the Saracen traders, converted to Islam in 1291 (Marsden, 1948). The spread of Islam (most likely from India) can be identified as occurring via island-like centres from the 13th century (refer to Figure 3.1). The first Malay ruler who embraced Islam in the region was Sultan Maliku Salleh of Pasai (Sumatra) (Winstedt, 1923).

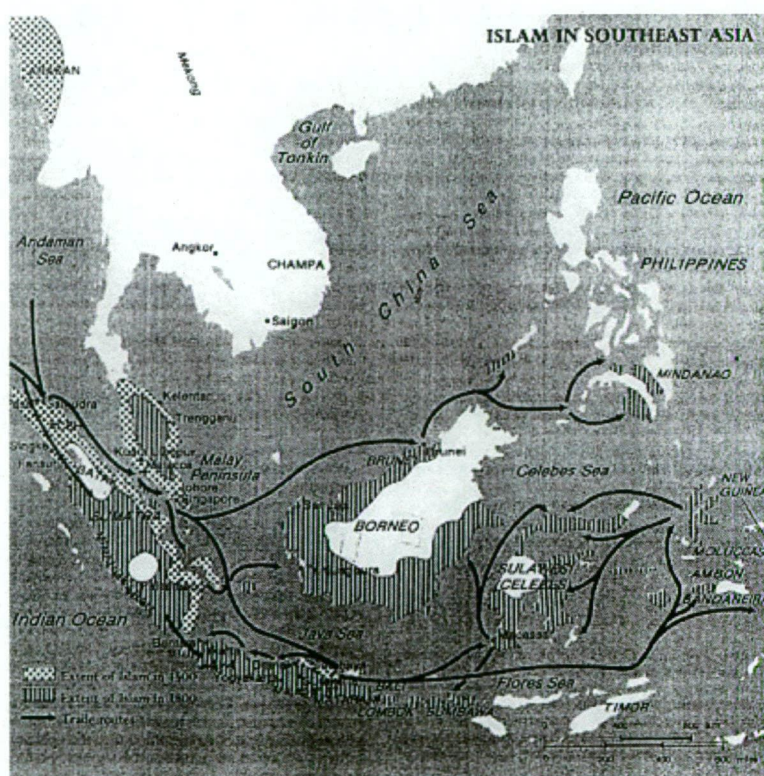


Figure 3.1: Map showing how Islam spread in South East Asia (Source: Johns, 1985, p.407)

3.1.3 Islamic influence after 15th century

By 1500 AD, the influence of Islam was limited to the North and East coast of Sumatra, southern Java and coastal areas of the Malay Peninsula (Cox, 2000). By the end of the 15th century it appears that most of the Malay kingdoms had converted to Islam, with Malacca as one of the first and most influential centres of the new religion, with its sizable and rich group of Tamil Muslim traders (Winstedt, 1923).

The spread of Islam has an Arab source, but the spread of the religion on Malaysia is not directly influenced by the Arab countries. It appears that the early influence came from India, particularly from the west coast region, including Gujerat and Malabar (Drewes, 1985). The conversion to Islam brought with it the establishment of small Koranic schools, where most pupils learned by reciting parts of the Koran in Arabic and only a small minority became proficient in reading and writing. Conversion to Islam resulted in a number of Malay translations of Islamic works of jurisprudence and religion. The first known Malay history was the *Sejarah Melayu* (Malay Annals), written in the 15th century in Malacca (Winstedt, 1948, p.130). Also, there is some literary evidence of religious schools at the time, possibly run by Indian Muslims.

Drewes (1985), considers that the Southern Indian origin of Islam is the more correct historical hypothesis. This assumption is based on the presumed derivation of the title of the Malay religious teacher *lebai* (Winstedt, 1948, p.20) from the Tamil word *labbai* (or *ilappai*) and he considers it irrelevant whether this is interpreted from the South Indian Shafii Muslim sect called *labbai*, centred at Nagore. It is difficult when reading from the *Sejarah Melayu* (Malay History) to identify when exactly Islam began to play a role in South East Asia. It is roughly estimated that this occurred by either the 14th century in Pasai or the 15th century in Malacca (Cox, 2000). Generally, it can be said that a predominantly Muslim upper class education was based on Islamic religious schools known as *madrassa*.

The full history of Islam in Southeast Asia is still unexplored, apart from the history of the generation of trading centres at focal points in the archipelago (Winstedt, 1923). Additionally the urban history of the region is disparate and abrupt and the process and character of Islamisation is therefore of the same character. Lines of communication between urban centres in the archipelago cannot be taken for granted and it is not known whether the development of religious schools and centres of learning was consistent in Malacca, Aceh, Palembang, Banten, the port cities of North-East Java or Makassar. Each was autonomous and open to the influence of a particular school of religious teachers (Cox, 2000).

3.1.4 Chinese influence

Chinese trading and visits to the Southeast Asian region may have begun in pre-historic times. Around 640 AD the *New History of the Tang* mentions the first embassy to *Mo-Lo-Yu*. This refers to the country of *Malayu*, situated on the east coast of Sumatra in the region of Jambi. The pilgrim, I-Ching, stopped off there for a time in 671 AD and from his memoirs we know that between 689 and 692, Malaya (Malaysia), was absorbed by *Shih-li-fo-shoh* or *Srivijaya* (Winstedt, 1923, pp.126-127; 1950, p.37). I-Ching had travelled to India and had embarked from there to return to China (Cox, 2000). Evidence of the early introduction of Islam to China in 1657 AD is based records of a *Mussulman* (Muslim) who held a position on The Astronomical Board at Peking. There are also Chinese records of Kedah in the 6th century; however, a stronger Chinese presence in the Peninsula can only be identified in the 15th century in Malacca, both in the *Malay Annals* and slightly later from Portuguese sources (Winstedt, 1923, p.132; 1948, p.18). According to Johns (1985), the oldest Chinese community in Malacca, is known as the *Baba and Nyonya*. Legend has it that their ancestors first arrived in Malacca on the ships of the Ming Admiral, Cheng Ho in the 1420s. They were given land for a settlement around Bukit China, where some intermarried with local Malays. The children from this mixed marriage are called *Baba* and *Nyonya* in Malacca or *Peranakan* (Kheng, 1998, p.9). The Chinese constituted 6% of the population of Perak in 1901, where the tin mining area of Larut Valley is located (Means, 1970). Chinese immigration increased rapidly from between 1880 and the 1930s.

3.2 Early European educational influences in Malaysia

The first Portuguese arrived in Malacca in 1509 and had forcibly taken over the government of Malacca by 1511 (Winstedt, 1948), governing for 130 years. The Portuguese had little contact with the interior of Peninsular Malacca (Bastin and Winks, 1966). They were, however, involved in a number of wars with the Achehnese both in Malacca and in Sumatra (Winstedt, 1948). There were never many Portuguese in Malaya and their numbers in Malacca rarely exceeded 600 (Bastin and Winks, 1966). Missionary work started in 1545, with the arrival of Saint Francis Xavier. Malacca became the seat of a bishopric in 1558 and a cathedral and a state subsidised school were built. The Portuguese influence persists today in the

Malay language, which includes about 450 Portuguese words. Bahasa Malaysia was also heavily influenced by Dutch and particularly by English, containing many hundreds of cognate words.

Bickmore, an American naturalist who sailed through the islands of Southeast Asia in the 1860s, supported this view. He took his lessons in Malay, the common language of the whole archipelago. The Chinese community leader was called *Kapitan Cina* by the Portuguese, a title that was continued by the Dutch and the British. It was probably during this period that the Malay language began to absorb foreign words, such as *sekolah* (Portuguese for school), *almari* (Portuguese for cupboard), *Feringgi* (which means Portuguese), *mandur* (Portuguese for overseer), *teko* (Chinese for kettle), *cawan* (Chinese for cups), *market* (British for market) and *bolero* (Dutch for shirt) (Kheng, 1998, p.11).

3.3 The Portuguese influence 1509 to 1640

3.3.1 Portuguese schools

In 1532, the Confraria da Misericordia was founded in Malacca and the first European school on the Malay Peninsula was started by St. Francis Xavier (Leo, 2004) and was opened in 1548 as the Malacca College (Winstedt, 1948). The teaching subjects included Latin and Portuguese. The school was open to both the Portuguese and the local children of Catholic converts. By the end of the first year, Fr. Francisco Peres wrote to Ignatius de Loyola that the school had 180 students. The subjects mentioned included Grammar and Latin. The school functioned in the morning and afternoon and at midday the boys were brought to the chapel at St. Paul's Hill, where they had religious instruction. In the afternoon, the school reopened for classes.

The school programme was developed to cope with the large number of students, as the capacity of the building was small. This practice of teaching in shifts is still used in Malaysian and Indonesian primary schools as a response to the climate, the large numbers of students and limited facilities. This school has survived to modern times as the College of St. Paul. It was the first boarding school, and a pioneer of all Christian missionary schools in Malaysia (Leo, 2004).

There is very little information in the literature published in English on the education system of the later Dutch colonial era in Malacca. As the College of St. Paul survived the Dutch period it can be assumed that the College and the private Koranic schools of the Portuguese period also survived, although in a reduced scale in a town reduced in population from 20,000 to around 5,000 during the Dutch era, as described in the following section.

3.3.2 The Dutch era 1641 to 1864

During the 17th and 18th century, the Dutch settlers were the paramount European influence on the Malay Peninsula (Winstedt, 1923). However, after 1798, Malacca was reduced to a governor's province, as the Dutch ruled from Batavia in Java (Winstedt, 1948). In the Malay view, the Dutch were only interested in extracting profit from the land and they gave nothing in return, including education. There is a Malay proverb, '*seperti Belanda diberi tanah*' (translated as '*it's like giving land to a Dutchman*'). It can be used to describe the Dutch attitude to educating Malays while being an occupier, for unlike the British who contributed to education development during their occupation of Malaysia, the Dutch were not interested in social intervention in Malay society, preferring to concentrate on trade made no contribution to education.

3.3.3 British influence

The Dutch had expelled the Portuguese from Malacca in 1641 and in 1795 were themselves replaced by the British, who had occupied Penang in 1786 (Gullick, 1981). In 1815, a proposal for a school on Prince of Wales Island was sent to the Governor and The Church Square was allocated for the school site. The plan for the school was based on Dr. Bell's ideas in Madras (Ung, 1989). Bell initiated monitor schools, better known as *Madras schools* in England, so-called after his experiments in Madras in 1808. Later, the method was applied in the *Lancasterian schoolrooms system*. The plan was divided into two rooms, with older students teaching younger students. Allocation of space for each student was six square feet (approximately 0.6 square metres). The architecture was plain, with white-limed walls and floor. The schoolrooms were furnished with long writing desks and benches. The space was left as open as possible for circulation (Seaborne, 1971). A day school for boys was opened in Penang in 1816 and the Penang Free School (the first English school), was

born. The Chaplain was forbidden to undertake missionary work and was allowed to educate both in English and Malay (Gullick, 1981).

The Penang Free School was believed to have taught Malays in the Malay language in 1821 (Cheeseman, 1955). The term 'free' is not related to payment or non-payment of fees, but merely implies freedom of learning for all, rather than just the *bumiputra* or the Malays (Gullick, 1981, p.33). The school provided education to male students who had not been to school previously, ranging from the age of six to nineteen. This was due to the new realisation of the importance of education of the Malay race (Cheeseman, 1955). In 1821, two schools for Tamils and Malays (offering instruction in their native languages) were opened within the school premises. The Tamil School continued until 1823 (Arasaratnam, 1979). Science was introduced into the school curriculum in 1923. In 1936, Science classes were started for Queen's Scholarship holders and for the first time an extension of the curriculum to include extra-curricular activities occurred.

The physical education included: gymnastic classes, volleyball, basketball, rugby and football. Swimming was introduced in 1936 and life saving was also taught. Penang Free School conformed to the Education Ordinance of 1957 and later the requirements of the National Education Policy of 31st August, 1957. It became a national-type fully assisted secondary school, run by a newly constituted Board of Governors. No outdoor teaching was conducted, except for Physical Education and sports activities.

3.3.4 Early education in the Straits Settlement

There were only missionary schools in the Straits Settlement (Penang, Malacca and Singapore) before the founding of the Singapore Institution in 1823. The British Protestant Mission to China founded the Anglo-Chinese College in Malacca in 1818. The founders were missionaries, such as the Chinese scholar the Reverend Robert Morrison (Stevenson, 1975). The objectives of the school were to promote Christianity, English and Chinese languages and literature. At its peak in 1834, there were seventy boys at the school (Begbie, 1967). Other 'free schools' were: the Raffles College in Singapore (Singapore Institution), founded in 1823 (Winstedt, 1948, p.131) and the Malacca High School. Both were set up to produce local

government staff and local school teachers (as with the Penang Free School), (Tregonning, 1969; Stevenson, 1975).

3.3.5 Earlier Portuguese and British schools on the Malay Peninsula

Up until the present day, the influence of Portuguese and British colonialists can still be seen in the building materials and the design of interior spaces of Malaysian classrooms. The use of clay bricks and cement render as finishes derived from Portuguese and British tradition, as did enclosed interior classrooms spaces. Raffles College in Singapore and the Penang Free School (PFS) were both founded during British occupation in the early 19th century. They were designed to give an English type of education to the Malay leaders in the British administration. These educated Malays filled new positions as local magistrates, judges and superintendents of *Penghulu* (village elders) to help in the British administration. These local administrators mostly had an English language school education. The royals were also among the first to be convinced that a British type of education served their own interests in the increasingly English-dominated region. Among them was Sultan Idris, a young Prince of Perak. In 1884, he visited London and was attracted to the British education system. When he returned home in 1888, he set up a *Raja Class* (Royal Class) in the royal capital of Perak, Kuala Kangsar, where a visiting British tutor taught the royal children for a year (Andaya and Leonard, 1982).

This school was the base for the opening of the first government English school in Kuala Kangsar known as Clifford School in 1927. After the Perak royals, the Selangor royals requested another *Raja School* (Royal School) for their princes. In 1890, the Selangor *Raja School* was built with a tutor from Oxford, but it was closed in 1894. The Victoria Institution opened in Kuala Lumpur, Selangor in 1895, for those who were interested in study.

The formation of the Federated Malay States (FMS) in 1896 united four states and created the Malayan Civil Services (MCS). In order to produce more educated Malays, a scholarship scheme was introduced, which gave intelligent Malay children from vernacular (rural) schools the opportunity to become local teachers. The selected students went to the first-class English schools, such as the Victoria Institution in Kuala Lumpur, Selangor, Taiping Central School in Perak (now King

Edward VII School) and St. Paul's School in Negeri Sembilan (Andaya and Leonard, 1982).

In the 1890s, the problem of the lack of suitable local administrators remained. Additional scholarship schemes were initiated to educate both English and Malay boys in the Anglo-Malay Department, at Victoria Institution and in the Kelang Anglo-Chinese School, both in Selangor. At the second Durbar (Conference of Rulers) in Kuala Lumpur in 1903, there were 310,000 Malays, with 2,636 employed in government administration and 1,175 in the police force. R. J. Wilkinson (the Federal Inspector of Schools) established the Malay College, Kuala Kangsar (MCKK), popularly called the *Eton of the East*, which opened in 1905. It followed the ideas of an English public boarding school but with an outward sense of Malay identity, demonstrated by using the traditional costume as the school uniform *sarong* (long skirt), *songkok* (head gear), *baju* (Malay shirt). One of the compulsory subjects was Koranic study and Friday prayers and other Muslim events were held as holidays. The first graduates in 1910 were absorbed into the Malay Administrative service. MCKK was known as *Bab-ud-Darjat* or Gateway to High Rank.

R. J. Wilkinson also influenced the printing of Malay literature in *Rumi* (the Malay language in Latin characters) to make it more accessible than the older *Jawi* (Malay written in Arabic characters) (Andaya and Leonard, 1982).

In 1916, R. O. Winstedt became the Assistant Director of Education (Malays) and increased the standards of Malay vernacular education. He initiated the Sultan Idris Training College (SITC) in 1922, (in Tanjung Malim, Perak), to teach the Malay teachers basic agricultural methods to be applied in villages. Middle class Malays of the SITC represented a different social hierarchy compared with the MCKK elite (Andaya and Leonard, 1982).

After the Second World War, SITC became a focus of literary activity, such as the Malay Translation Bureau in 1924. The contribution of the bureau was to produce textbooks for Malay schools and the introduction of the Malay Library Service in 1929 (Andaya and Leonard, 1982). The students from the *madrassa* system of the Unfederated Malay States (UMS), especially Kelantan, continued their studies in

MCKK, SITC, PFS and Malacca College from 1920 to 1930 (Andaya and Leonard, 1982).

3.3.6 Summary

In brief, Malaysia's education history has a rich and diverse background. However, the current situation, as outlined in Chapter 1, does not seem to reflect this history. It can be concluded that the history of education up to the present day in Malaysia is varied. For example, Malay education was strongly influenced by Koranic teachings, which later extended to secular subjects. The village *pondok* schools, because of their rural locations and the nature of the native buildings, may have had strong, although non-deliberate, connections with the surrounding natural environment. The independent religious schools (*madrasa*) took a more suitable approach to school architecture in a tropical climate: for examples *pondok* teaching used a more culturally appropriate pedagogy such as *halaqah* (circle or grouping for learning). This kind of focus on working in small groups within a class is mirrored by current Western pedagogy as. Small group teaching allows teachers to function as facilitators, rather than instructors. A synthesis of Western and Eastern teaching styles would support new arrangements of classroom space, necessitating change away from a regimented seating arrangement, which is the standard approach at present in Malaysian primary schools.

There are elements of Islamic, Chinese and Tamil school education in the present school system of Malaysia. However, school architecture mostly still follows European architectural trends and construction techniques of the 19th century. The simple building traditions of most native Malay *pondok* schools of the past, using local materials, have yet to find their place in contemporary school architecture although several other countries such as Australia, Pakistan and India are moving in this direction, as described in Part B.

Part B

3.4 Linking current educational practice and philosophy

The evidence from the extant literature suggest that there is a need to incorporate environmental education in the Malaysian primary curriculum. At the world's first intergovernmental conference on environmental education in 1977, organised by the United Nations Education, Scientific and Cultural Organisation (UNESCO), a declaration was adopted by acclamation. The Tbilisi Declaration noted

the unanimous accord in the important role of environmental education in the preservation and improvement of the world's environment, as well as in the sound and balanced development of the world's communities (1977, p.1).

In Malaysia, the major gap in current educational practices is in understanding the place of the outdoor and natural environment in education. The design of school buildings could facilitate environmental education at the earliest stages of a child's education.

Among the aims of environmental education, which are relevant to the concerns of this research, several pertinent to outdoor education are listed below, from the Tbilisi Declaration (UNESCO-UNEP, 1977, p.3):

- Environmental education is the result of the reorientation and dovetailing of different disciplines and educational experiences which facilitate an integrated perception of the problems of the environment.
- Environmental education should bring about a closer link between educational processes and real life, building its activities around the environmental problems that are faced by particular communities and focusing analysis on these by means of an interdisciplinary, comprehensive approach.

Thus, the introduction of environmental education on the grounds of Malaysian schools could have many positive benefits.

3.5 The influence of pedagogical ideas on primary school design

New building design concepts in school architecture reflect recent education pedagogies. In the Northern hemisphere, extensive changes in primary school education have been influenced by thinkers such as Dewey, Foucault, Gramsci,

Neill, Montessori, Piaget, Makarenko, Steiner, Vygotsky and Le Febvre. A considerable body of research into human geographies (see for example Moore, 1986; Holloway and Valentine, 2000), reflects the importance of how children's geographies take form. As Holloway and Valentine (2000, p.18) point out, there are:

... three interrelated ways in which geography matters in the social construction of childhood. First, geographical work can be used to counter the danger of ethnocentrism by showing that place matters. These places that matter ... are simultaneously global and local, places where children both experience and rework global processes in creating their own worlds of meaning. In places such as the playground, the school and the home children's identities are made and (re) made through the sites of everyday life.

There has been increased concern about school architecture and Environmentally Sustainable Design (ESD) issues in Asian-Pacific countries and former British colonies, such as Pakistan (Siddique, 1977), Indonesia (Afshar, 1970, pp.29-44) and Australia (Fantin, 2002). Some research has been attempted into innovative classroom design solutions (as shown in Appendix B; Figures B1 and B6), which are suitable for tropical and hot climates (Afshar, 1970, p.29; Siddique, 1977; Seaborne and Lowe, 1977; Hattstein and Delius, 2000, p.179 and p.626; Fantin, 2002).

3.6 The education context

The teacher-orientated system in Malaysia is considered to be lagging behind contemporary global education trends (Lebar, 2000). There has been considerable research into significant factors which affect how children learn, including their cultural background. The literature review in this section provides a general overview of contemporary educational pedagogy, relevant to the subject matter of this research.

3.6.1 The rethinking of education in the 20th century

This section begins with a brief discussion of Piaget's concept of learning in children and Vygotsky's genetic approach to the development of concepts of learning, in early childhood and youth. Both saw the child not as an imperfect adult but as a being in the process of constructing self (Vygotsky, 1986). Piaget was a Swiss psychologist who saw the child as "constantly creating and recreating his own model of reality, achieving mental growth by integrating simpler concept into higher-level

concepts at each stage” (Piaget, 1972, p.6). Piaget was the “first to make a systematic study of the acquisition of understanding in children” (Piaget, 1972). Piaget identified four stages in the development of a child’s ability to think. He identified that the child moves to the concrete operational third stage, between the ages of seven to twelve.

At this stage however, “intelligence is demonstrated through logical and systematic manipulation of symbols related to concrete objects” (Huit and Hummel, 1997, p.2) for this to occur successfully, Piaget stipulated that children’s everyday environment should be generally stimulating (in Berk and Winsler, 1995). Discovery learning and supporting the developing interest of a child are two primary instructional techniques “it is also recommended that teachers use a wide variety of concrete experiences to help the child learn.” Huitt and Hummel (1997), suggest that teachers should provide opportunities to play with clay, water or sand in early childhood education in order to give students a chance to manipulate object and test out their ideas at the concrete operational stage (p.1).

Thus, it is clear that, Piaget’s concept caused “re-evaluation of older ideas, of the child, of learning, and of education” (Piaget, 1972). In a similar way to Piaget, Vygotsky observed that, the child is like “a building actively constructing him/herself” (Berk and Winsler, 1995, p.104). However, Vygotsky focused on the social environment as “the necessary scaffold, or support system, that allows the child to move forward and continue to build new competencies” (Wood and Middleton, 1975, p.26) and “as the necessary support system enabling the child to undergo cognitive growth and increase its performance on a wide variety of tasks” (p.127). For children, as with adults, much of their best learning occurs when they are actively engaged in a problem, especially with others. Effective scaffolding requires as its first component, engagement of children in an interesting and culturally meaningful, collaborative problem solving activity. Children learn best in small groups via social interaction with others, such as peers, teachers and parents. For example, in the early childhood programme at Reggio Emilia in Italy “the particulars of what happens from day to day depend on joint teacher and child decision making during mutual explorations” (Berk and Winsler, 1995, p.144). The

teacher creates “activity settings designed to stimulate dialogue and co-creation of knowledge” (p.145).

Clearly, interaction with natural materials and the environment would be encouraged in Vygotskian education, particularly in regard to exploration and creating stimulating activity settings. In addition, he encouraged children to represent nearly everything they do and think about including such difficult concepts as “ideas about experiences that promote self-regulation” (Vygotsky, 1986). Experiences of play, social interaction and learning in an outdoor classroom environment could be used as the basis for inquiry, reflection and representation, in a variety of forms and using various media such as clay, paints and writing.

Vygotsky’s concept of the ‘zone of proximal development’ (ZPD) could also be explored effectively in a natural environment. The ‘zone of proximal development’ can be defined also as “difference, which exists, between what a child can do on their own and what the child can do with help” (Berk and Winsler, 1995, p.147).

According to this concept the ZPD is a “hypothetical dynamic region in which learning and development, take place in childhood” (Berk and Winsler, 1995, p.5).

As Berk and Winsler (1995), state, “cognition is always situated in activity” (p.27). It is clear that the more varied the space and materials available to children, the more cognitive development could be stimulated, under the guidance of adults or “more capable peers” (p.26).

Although it is easy to see the applications of the outdoor classroom environment to environmental science, history, geography, maths and languages subjects, the school grounds can also be used as a space to stimulate learning in other developmental areas. As suggested, the nearest choice for teaching and learning outdoors is the school grounds itself, which can be used as a ‘zone of proximal development’ for stimulating the child’s creativity in associated subjects such as languages, especially essay writing, comprehension and composition. Pupils can achieve better understanding by interacting with the environment and by interpreting their experience of it with others (Vygotsky, 1978b). It is suggested by the literature on the development of cognition in children that children have a ‘genetic epistemology’

(Piaget, 1972; Vygotsky, 1978a). According to Jones (2000, p.29) 'genetic epistemology' describes how children learn according to their genetic factors, including the surroundings in which they grow up and the surrounding cultural influences. In addition, cultural factors affect children's ability and rate of learning. Such cultural factors include the design of buildings and human geographies as children play, live and learn "in strongly striated spaces presented by adult geographies." Holloway and Valentine (2000) state that "schools, like playgrounds are also institutional spaces through which adults attempt to control students and through differences children are re-inscribed" (p.14). Punch (2000) states that "very few studies have considered the importance for children of combining play with other activities such as work and school" and suggests, "children can be the most appropriate informants to consult about their own social world" (p.58).

The architectural form and layout of school buildings and outdoor spaces has remained an important factor in education, as design of schools and play spaces affects the behaviour of the users. According to Sir Winston Churchill (Banning, 1990, p.20), "building design will shape the occupants' activities." Gagen, (2000), notes that:

... children's lives are commonly understood as closely orchestrated by institutional frameworks. Educational establishments ... represent the spaces through which societies expect children to be socialised towards adult's norms. Learning environment then, are often the spaces through which children become aware of and beginning reproducing social identity (p.213).

The construction of children social identity includes the construction of gender, which is reflected through playground design for example, by the creation of boys' and girls' play areas (Fielding, 2000, p.227). As Jones (2000), points out in his article *Melting Geography: Purity, disorder, childhood and space* the design of space for use by children should be influenced by their needs:

...there is a need for geography and sociology to differentiate between the experiences of children of differing age and gender and a need to take account of the spatial, social, cultural and family contexts in which children find themselves (p.30).

It is, therefore, well-supported in the literature that the design and use of public spaces such as schools and outdoor areas is of crucial importance in promoting the

child's construction of self, which is an important focus of education. In addition, the variety of learning materials which nature provides for children is hard to replicate artificially. Sorbel (1990, p.8), observes that it is:

... crucial for children to participate in world-making or world-shaping activities. Children need the opportunity to create and manipulate. The creation of these worlds from plastic materials ... gives children the opportunity to organise a world and then find places within it to become themselves.

This involves making available natural material such as vegetation, sand and water in school settings. Moore (1986, p.40) asserts that "within such analyses, vegetation is seen as a key element" and are invaluable resources, as they enable children to have the opportunity to design and modify their environment. The importance of children having access to the natural environment cannot be overestimated according to Jones (2000), as "variety in the environments which children use for play, is now seen as critical for children's ability to be able to construct their own worlds in ways which are satisfying to them." Jones (2000), found in his study of urban spaces for children that "access and diversity emerge as the most important themes in childhood-environment policy" (p.39).

3.6.2 Foucault's analysis of power and control in relation to education

Foucault (1980, p.135) believes that thinking should involve self-criticism and return to history as a starting point. As a historian and a philosopher, his main discussion focussed on the relationship between power and knowledge. Foucault described how discipline by punishment could produce social power in society. Thus, education developed from being disinterested and objective, to partisan, and critical. Following Foucault's analysis of power and control, in the panopticon (trans. Sheridan, 1979), where social conformity was enforced by surveillance and the control of inhabited spaces, it is important to be aware of the sociological and cultural context of education. In other words how one manipulates institutional space (in schools, prisons and hospitals) affects the learning outcomes which can occur.

Further, Foucault's idea of knowledge was complex, involving the Nietzschean concept of the 'will to knowledge'. Knowledge was seen as 'invention' and as 'event' or at the very least as a series of events, involving curiosity rather than insisting on expertise. Curiosity is encouraged by the creative manipulation of space

in the designer of school environments for example, outdoor classrooms and playscapes.

In Foucault's view (1980, p.111) view "freedom is a practice ... the freedom of man is never assured of by the laws and institutions that are intended to guarantee them." Thus, Foucault's views are applicable to education in the sense that "to be free is to be able to question politics, to question the way power is exercised, disputing its claims to domination. Such questioning involves our ethos, our ways of being or becoming that we are. Freedom is thus an 'ethical' matter" (p.122). Increased freedom to move around and access different learning environments in the primary schools could then be said to encouraged the development of questioning skills in the Foucauldian sense.

The views of these Western philosophers are relevant to the Malay context, where power over the behaviour of students and the knowledge they are taught, is in the hands of teachers. The use of indoor regimented classroom environments reinforces the existing power structures in Malaysian education. The authoritarian nature of the Malaysian education system ensures that "the underlying beliefs or structural codes of knowledge... [reinforce] the locus of power" (Foucault, 1980, p.193).

Philosophers such as Dewey and child psychologists such as Piaget (1972) and Vygotsky (1986), have broadened our view of how children learn. They stress the value of the individual and the importance of a democratic and culturally relevant approach to knowledge and enquiry. It is reasonable to suggest that these theories strongly disagree with the metaphor of controlled indoor space teaching practice utilised by the Malaysian government until now. This approach to education and architecture does not reflect the contemporary picture of knowledge or the methods of enquiry available to students in Western countries. Allowing more flexible use of teaching and learning space could create a more democratic approach to the relationship between power and space. By utilising outdoor spaces as extensions of indoor classroom, it may be possible to create an atmosphere of enquiry among children in current primary schools in Malaysia.

3.7 Other Western pedagogical theories

Dewey (1916, 1938) and Montessori (Lillard, 1972) encouraged critical thinking and direct experience of problems as a way of solving them. In their view, curricula should be modified to encourage independent thinking and a multiplicity of approaches to learning in order that children can learn to think independently and develop understanding. Other theorists such as Gramsci and Le Febvre examined issues of power, spaces and knowledge.

3.7.1 John Dewey's theory of democracy in education

The main purpose of Dewey's, theory of quality education (Dewey, 1916) was to promote social unity, which he represented as a progress from experience-based knowledge, expanding progress in all walks of life and areas of interest. Dewey saw education as a burgeoning process, incorporating the various conflicts of life. Among them, he included the connection of matter and mind, body and soul, humanity and physical nature, individual and social and theory and practice, which are basically the framework of contemporary democratic education, equipping students with the wisdom to conduct their later life. Sociologists such as William Thomas, George Herbert Mead, Freire and Dewey believed that in order not to be dominated by hegemonies in education and to be democratic, teachers should be able to demonstrate a diversity of knowledge ability beyond their communal space. They believed that young learners should not be limited to what the teachers themselves know (Dewey, 1938; Freire, 1973). Dewey's (1916, p.6) ideas expanded those of Plato and Rousseau in that they "... speak for the diversity of individual talent and for the need of free development of individuality in all its variety". Similarly

Dewey's ethics of *Valuation and Experimental Knowledge* "is oriented not just to the testing of old ideas, but to the creation of new consequences" (p.2). In addition, in his lecture on *Education in Relation to Form* he argues, "... the regulation of natural and spontaneous processes of observation, suggestion and testing, that is, thinking as an art" (p.3). Thus, Dewey's ideas support the value of observation and interaction with nature as a valuable part of education.

3.7.2 Gramsci's theory of hegemony

Gramsci (1971) developed a seminal theory about hegemony in education, which is relevant in the context of the Malaysian education system. Gramsci's concept of hegemony is applicable to an analysis of the indoor teaching orientation and the use of learning techniques as a control tool in the Malaysian context. According to Gramsci, providing limited classroom space and a restricted curriculum keeps the members of society under control for certain political purposes, starting from the primary school level. He suggested 'a back to basics' system for education, which should be dynamic in order to be state of the art at all times. Thus, it could be seen as threatening to government control of citizens' thinking processes.

3.7.3 Le Febvre's production of space as an influence education

In the 20th century education, Le Febvre (1991) concluded that spatial practice defines place; for example, the relationship between local and global by "... the representation of relationships by actions and signs, to enhance the spaces of everyday life" (the past is) represented by spaces with meaning such as symbolic, memorable, desirable or undesirable, benevolent or malevolent, sanctioned or forbidden to particular groups" (p.155). He believed in spatial freedom in education.

3.7.4 The 20th century educators: Makarenko, Steiner, Montessori and Neill.

Four 20th century educators and theorists whose ideas have influenced recent pedagogy, were selected. Their theories were compared with present Malaysian teaching practice. Neill (1971), Montessori (Lillard, 1972), Steiner (1976) and Makarenko (1976) and are included as these educators developed teaching theories and methods with an emphasis on the incorporation of the natural environment at different stages of the teaching process.

The approaches of these educators can be compared with extant practice in Malaysian Primary schools as shown in Appendix C, Tables C1 to C4.

In their attempts to make primary education more relevant to the needs of young children, Neill incorporates gardening into the curriculum, while Makarenko used farming and Steiner uses the forest as a setting for education. Montessori and Steiner both stress the importance of exposing children to educative materials made from

natural products, such as wood and natural fibres. However, there are important differences in their didactic methods. Makarenko developed a 'group pressure' philosophy. This relied on group guidance to rehabilitate individual students. He also used 'justified punishment' as a school method and farming or workshop work as educational tools, in the sense that students were learning by making. Neill's system used the individual approach to fit a new student in a group. He also used gardening and workshop tasks both as a reward and as a duty. Steiner, drawing on his experience as an architect, used the idea of pavilions in a forest, or other natural surroundings, to ameliorate the artificiality of indoor teaching. The setting becomes a part of the total physical environment, to be used as a teaching environment.

The Montessori method described by Lillard (1972) incorporates natural materials and child psychology into early childhood education. The method is based on the premise that children will develop at their own rate, if they are exposed to appropriate natural materials and well-designed teaching resources and environments. The child's learning is a process of discovery, similar to the developmental stages identified by Piaget. For example, water play is seen as a significant part of a child's cognitive development and children are taught the shapes of alphabet letters by feeling the texture of sandpaper letters. Toys are made from natural materials, such as wood and other natural fibres to ground the child's experience as a physical being in the real world. Lillard (1972, p.50) states:

... developments in education have recognised the importance of the natural environment as an integral part of the child's development. According to Montessori, education should facilitate learning and teaching should focus on providing an education in an environment, which is 'a nourishing place for the child'. As Montessori suggests, the environment in which children learn, should be designed to meet their 'needs for self-construction'.

The classroom should be a living environment, actively responsive to the continually changing needs of a growing child (Lillard, 1972). Steiner tried to achieve an environment conducive to the spiritual development of the child, (which he related to its biological development), through school building design. Steiner promoted an educational philosophy which emphasised the importance of environmental influences on the child and stressed the importance of the child's interaction with nature. He also tried to show the importance of architecture's influence on the way

we live and learn. Steiner's schools were surrounded by nature in a forest and Steiner suggested the use of natural timber materials and organic shapes for the building. Steiner's concerns with the built environment of the primary school are exemplified in the recently built Waldorf-Steiner school in Cologne (Hubner, 1998). Hubner integrates Steiner's holistic principles by developing 'organic forms' into a showcase of environmentally sustainable design. The school is designed with grass-roofs, untreated timber and passive solar heating, using recycled materials. Hubner tried to achieve qualities of space and light in the room to facilitate subjects such as arts and crafts, music and drama and other academic subjects, with all disciplines linked to the human mind and body. His design emphasises exchange of communication between performer and audience to create social development and self-confidence in students (Jones, 1999). Each classroom is designed to be polygonal and open in character, with individually differentiated characteristics for each space (Jones, 1999).

In the Gelsenkirchen-Bismark school (1998), Hubner created a design with an ecological awareness and community spirit for multicultural school students, while promoting ecological education (Jones, 1999). The notion of a school is interpreted as a family of rooms rather than a monolithic lump. The classroom design is in the form of freestanding pavilions (Jones, 1999). Hubner also worked with Winkel, designing school buildings which would enable Winkel's educational theory to be put into practice. Winkel's theory advocated learning by doing, in a similar manner to that developed by Montessori and Dewey, where the children "... work on insulated concrete foundations topped by lightweight construction in timber frame, calculated and cut to size by computer ..." Landscape architect Christof Harms developed an open-ended classroom design. According to Jones (1999), the curriculum included creating gardens of vegetables, herbs or flowers, to develop small fruit orchards, to collect water from the roofs, to keep small animals and to encourage butterflies and bees (p.2).

The design features of the innovative schools mentioned above support the new pedagogies extant in Western countries (refer to Appendix C, Table C2, which compares the design features and demographics of Malaysian primary schools with innovative 20th century European schools mentioned).

Montessori, Neill, Makarenko and Steiner, changed the traditional curriculum to suit their educational aims. These were to develop character; to foster social adjustment and knowledge and to accommodate the different needs arising from the unexpected circumstances of the students (refer to Appendix C, Table C3).

3.7.5 Education concepts from Malaysia's neighbours: The Thai Model

According to Ajarn Chai-anan Samuthavanji (2001), Thais have a unique acumen for being *sanuk* (playful) people. They rarely ask colleagues 'where they have been' or if what they have been doing was interesting or meaningful. They simply ask whether it was *sanuk* or not. According to Samuthavanji, information technology enables us to reinvent learning with *sanuk*, as our forefathers experienced it in reality. It is ironic that our children find convergence of learning and *sanuk* in the real world of nature, whereas too often they find classroom learning dull and irrelevant. Such reflection on personal practice is often crucial for change to occur. Reflection on the type of learning which we hope to encourage is needed when considering the design of actual teaching and learning spaces (Harvey, 1996). Similarly, Malaysian culture values '*lepak*' (relaxing and observing) and do not value regimentation (Ramli, 2003).

Samuthavanji (2001), writing about Thai education, asserts that to achieve the proposed innovations in curriculum, development and learning, requires changes in methodology based on research into human learning, which will increasingly become too complex and diverse to be supplied by classroom teaching alone. Being formally taught is just one among many paths towards learning. In this respect, what is meant by curriculum has to be reinterpreted, as curriculum is always associated with teaching and the notion that 'teaching leads to learning'. If these assumptions are true, formal curriculum will become less relevant or even irrelevant in the new paradigm of learning, which focuses on learning to think analytically, rather than rote learning. In the new Information Age, increasingly, the curriculum is becoming too complex and diverse to be supplied by classroom teaching alone (Ramli, 2001). Part of the preparation for the younger Malaysian generation to participate in global education, involves the reassessment of school architecture and the spatial design of teaching spaces. Regimented classrooms with aligned rows of seats which promote

linear thinking and teacher-centred learning should be avoided, as they are considered out of date in this new millennium (Nair, 2001).

3.7.6 Eastern philosophy and its relevance to 21st century education

There are similarities in approaches to teaching and learning between religious traditions of instruction. In Islam and Buddhism, it is believed that there are three purposes of education. According to Pradubraj (2002), key Buddhist principles of education are *panya*, *samanthi* and *sila*. *Panya* (or wisdom) is to learn to know oneself. *Panya* encourages the use of facts and information with lucid justification and reasoning, as a tool to learn to know about oneself and one's relationship with the surrounding world. *Samanthi* (or concentration) is used to seek and tackle the core problems produced by conflict in the world. *Sila* (or moral conduct) is concerned with compliance with the laws and regulations that govern relations with other communities, including the surroundings. In the Buddhist view, these three forms of education are needed in order to see things beneath the surface with deep understanding. Thus, Buddhist principles encourage the development of the whole person, in community. Buddhist principles then reflect the educational emphases of the 20th century educators referred to in this section, as explained above.

This literature review has traced the development of schooling from mediaeval monastic planning to the modern *madrassa*. These architectural styles have in common that they are compartmentalised and the classroom design is isolative, which leads students to be solitary, less sociable and less enquiring. It is suggested by 20th century educational philosophers, and intrinsic to Christian, Buddhist, Confucian and Islamic principles, that education should encourage positive social interaction to facilitate the child's development. The underlying principles of all religions encourage students to understand human beings and their relationship with the surrounding environment.

3.7.7 Present Malaysian educational ideas

The former Prime Minister of Malaysia, Dr. Mahathir Mohamad, was originally Minister for Education and as such, education was an important issue on his agenda. Educational policies were strongly influenced by his radical ideas on education during his thirty years in office. Dr. Mahathir Mohamad formulated, for example,

both the University Act and Internal Security Acts of 1963, while he was the Minister for Education (Ramli, 2003). These acts were draconian in their attempts to control students, for example, gatherings of more than three higher education students without permission were punishable by prison sentences. The Act can be interpreted as an attempt to create an obedient society of students, who will not discuss or question government policies. A number of academics and students have been sentenced from time to time under these Acts, as their ideas were seen as threats to the government's control of the population.

Education in predominantly Muslim countries seems to be out of step with the liberal enquiry encouraged in Western countries and Malaysia is no exception. For example, according to Ramadan (1985, p.330), one of the major ideological problems in the Muslim world is:

... blind obedience in a society without individual opinions, even if there is unjustified action from the government. This creates a confusion between religion and politics where religion is used as a propaganda tool to justify the government's policies, through various instruments, among them education aims.

The present education system could be liberalised by diverting funds used to enforce conformity and curb reformation into exploring new educational ideas. According to Ramadan (1985, p.330), the extant ideology underpinning Malaysian society produces conformist attitudes in the population as follows:

There is reluctance to change, let alone to accept anything new from the West, including state of the art technology ... Muslims today tend to be deeply suspicious of change. Such societies become stagnant instead of being dynamic, because they avoid intellectual discourse outside the Muslim world ... rather than embracing the new in education and philosophy.

For Ramadan (1985), Islam has become a bastion of conservatism, looking backwards to the Dark Ages. Mohd (2001) states, " ... historically Islamic societies once produced scholars and scientists who were at the forefront of research and scientific discovery. We have to make an effort, be hard working, strive hard to seek knowledge and all skill...". The effect of this statement is that Islamic society has been seen as a backward educational and research society. However, since the new millennium, and in light of the current Prime Minister's (Abdullah Ahmad Badawi) policies, this is being addressed, particularly in terms of the '*hadari*'. The concept of

the Islamic '*hadari*', as described by the current Prime Minister of Malaysia, reflects how the development of the Malay Muslim society in Malaysia should be hand in hand with the sustainable global agenda at present (Isa, 2005). In brief, the current Malaysian education ideas reflect the local requirements to achieve global standards.

As noted in Section 3.4, the Tbilisi Declaration (UNESCO-UNEP, 1977, p.3) "[e]nvironmental education is the result of the reorientation and dovetailing of different disciplines and educational experiences which facilitate an integrated perception of the problems of the environment". Further, "[e]nvironmental education should bring about a closer link between educational processes and real life, building its activities around the environmental problems that are faced by particular communities and focusing analysis on these by means of an interdisciplinary, comprehensive approach".

As observed, the teacher-orientated system in Malaysia is seen to be lagging behind contemporary global education trends (Lebar, 2000). One of the fundamental concerns of education reforms in Malaysia is to develop teachers as reflective practitioners, who will use research and enquiry as a basis for their professional development. The element of reflection is the basis of Islamic philosophy and forms the basis of the National Education Philosophy in Malaysia.

3.7.8 An overview of global education ideas

Many theorists have contributed to the rethinking of educational practice in the 20th century, as detailed previously in this chapter. In previous centuries, children have studied in temples, synagogues, churches, monasteries and mosques. They were imbued with received knowledge and taught to develop their behaviour in accordance with the dictates of society and religion. This form of social control was facilitated by the following three types of educational curriculum: formal; non-formal and hidden (Ramli, 2001). In the West during the last thirty years, education philosophy and practice have become increasingly similar in most schools, whether public or private: the influence of the new pedagogy is widespread. As a result, teaching now focuses less on control, rote learning and punishment and more on student-centred learning (Ramli, 2003).

However, in Islamic countries, such as Malaysia and Indonesia, the reverse is true. The worldwide trend in education in the last fifty years has been to separate secular life from religion. Teachers have increasingly, in the last fifty years, taken over the former teaching role of monks, rabbis, priests and *ustazs* or *ulamas* and lessons on ethics have replaced religious teachings in public schools in Malaysia (Ramli, 2003).

Factors other than educational philosophy and approaches to pedagogy also need to be considered in educational planning. These are discussed in the following sections.

3.8 School demographics

3.8.1 Location of schools

Thirty years ago, Malaysian missionary schools, which were a legacy of British colonial domination, produced high achievers, both academically and in sports. These schools were situated in the city. Wanting the best for their children, parents tended to send them to these schools. However, this caused traffic congestion in the cities, especially during the morning and evening (Cheong, 2002). Today, the government policy is not to build schools in urban areas; rather they are built in suburban areas, especially as part of the development in any new housing areas (Ali, 1986). Thus, traffic congestion in the city is reduced, as part of transport planning. The Malaysian government plans to build many schools in future in new housing areas (Ramli, 2003). The tendency to build schools in less built-up areas would facilitate the use of outdoor classrooms, as increased available space would allow the incorporation of innovative school design, which could include the environment in the design solution.

3.8.2 Diversity

According to Southworth (2003), 'smart schools' of the future should be diverse schools with diverse curricula, made up of students from all ages and walks of life sharing their wisdom and ability in the arts, with the commercial and physical interests found in their community. Assessment should be not just based on academic achievement and learning should be multi-faceted. Included in Southworth's concept of the smart school is 'smart play' as part of the curriculum (Ramli, 2003).

3.8.3 Class size, classroom spatial organization and teaching resources

The average number of students for each school in Malaysia is 300, while the pupil to teacher ratio is forty-five students to one teacher (Mohamad, 2001). Nair (2001) suggests that theoretically, a smaller class provides better quality of education. In fact, there are more illiterate students in small schools in Malaysia, which have a small number of students in each classroom, than in bigger schools (Aiyer, 2002). Nair, an international classroom designer, believes classrooms should be adjustable spaces, so that they can be used as learning centres for different purposes and to maximise use of classroom spaces and which can also be used by the wider community. He also sees classrooms as general spaces and teachers as facilitators. As part of this flexible education process, students should be provided with computers so that learning can be available twenty-four hours per day online anywhere (Andrews, 2002, p.17).

A Montessori school designed in the Netherlands by Hertzberger (2002) is an example of the de-institutionalisation of school architecture in Europe, producing a flexible arrangement of classroom space in a community setting, which also incorporates the natural environment by the incorporation of water views on two sides:

Occupying the two lowest levels, the school seems intent on slipping out in every direction from under the houses, which are sited three-metre intervals to let at least a minimum of sunlight down into the main assembly hall of the school. The double-height hall is the locus of school activity. All classrooms are extended with a prefatory space as a local widening of the corridor.

Thus, learning is not restricted to the isolated classroom but extended into the hall and external spaces. There is also a deck on the canal, which extends the students interaction with the outdoor environment. This design reflects the importance of grounding children's learning in the natural world, as stressed by Montessori (Lillard, 1972).

Golledge and Zannaras (1973), who carried out an experimental survey on the cognitive aspects of human spatial behaviour, support the importance of integrating the school environment with nature on the journey to work or school. In addition, their research recognised that most urban dwellers consider their physical

surroundings to be as important as the associated social neighbourhood. It can be assumed from this research that varied experience of the physical environment is an important factor in the cognition of urban structure. To experience a school in an environment which is different, both in quality and physical presence from the monotonous built surroundings in the Malaysian urban environment, could be an important factor in providing a richer cognitive experience to younger children, as well as giving them a pleasant association with school.

3.8.4 Connection between space, schooling and pedagogy

According to Fielding (2000), there is a huge potential for investigating and considering the role of space in schools and for a greater understanding of the dynamics of children's geographies, so as to improve pedagogic practice.

Researchers in education need to consider the connections between space, identity, schooling and pedagogy. This awareness needs to be woven into educational policy, in order to produce environments which maximise the child's construction of self.

Moore and Young (1978, p.12), note that children have the ability to "carve out opportunities for play irrespective of the level of formal play provision."

Unfortunately, there is less and less opportunity for children to access outdoor spaces for imaginative play, particularly in rapidly urbanising Asian cities, such as Hong Kong and Kuala Lumpur. According to Lynch's 1997 Melbourne study:

The increasing urbanisation of society and the tendency of mothers of young children to seek paid employment, makes it increasingly likely that children's main play area will be the school. In addition, children who live in cities are spending more time at school, from a younger age (cited in Holloway and Valentine, 2000, p.12).

Furthermore, according to Prout and James (1990, p.6) "children are and must be seen as active in the construction and determination of their own social lives ... [They] are not just the passive subjects of social structures and processes". It is therefore essential to build choice into the design of school spaces, particularly classrooms and playscapes.

This is particularly relevant to the Malaysian context, both from the point of view of the current restricted access to space and the prevalence of teacher-centred pedagogy, resulting from the legacy of British colonialism and Islamic conformity. It is widely recognised by human geographers (Holloway and Valentine, 2000) and education

theorists (Kong, 2000) that if children are to achieve their maximum potential, it is important to focus on the design of “those everyday spaces in and through which children’s identities are made and remade such as classrooms and playgrounds” (Laurie *et al.*, 1999). Thus, space is an important element in the construction of childhood.

3.8.5 Implications of the extant research for primary school design

Although, Malaysia has many schools, few are in natural landscape settings. Even rural schools offer very little visual and psychological stimulation. To achieve a more stimulating outdoor school environment, the natural environment could be recreated by appropriate landscape design. There are a number of architects working in the tropics who have attempted to incorporate features of the local tropical environment into the design of public buildings, as exemplified in Fantin’s (2002), studies on Australian Indigenous Schools in Northern Australia. These innovative approaches point the way to a symbiosis between nature and architecture. In order to promote this connection, classrooms should be designed in such a way that they have a direct connection to landscaped school grounds. Children who are allowed to have a direct connection to the natural environment may prove to do better in their studies and benefit from more innovative spaces for teaching, learning and play (Lillard, 1972).

The education systems of Australia and other Western countries pays some attention to children’s interaction with the environment, both in terms of play and incorporating the environment into the primary school curriculum (Beer and Sheat, 1992c; 1992d). However, in Malaysia, little attention has been given to this area of learning and there is less focus on the playground or outdoor space as a learning environment, as learning is considered to occur best indoors (Ramli, 2001). Landscaping is intended to beautify the school grounds, rather than to provide a visual connection with the landscape for children in Singapore (Kong, 2000).

3.8.6 The impact of the institutionalisation of childhood

According to Gagen (cited in Holloway and Valentine, 2000), increased institutionalisation of childhood makes it even more imperative that children should have exposure to outdoor learning environments:

A central theme in both recent and long-standing work on children and young people is the institutionalisation of major aspects of their daily experience. From child-care through formal schooling, to the myriad ways in which children's leisure is organised and contained, children's lives are commonly understood as closely orchestrated by institutional frameworks (p.213).

It follows that institutions have objectives contained within the way that they organized indoor and outdoor space in classrooms. According to James, Jenks and Prout (1998), the agenda of school curricula is

never accidental and certainly, not arbitrary. On the contrary, educational establishments represent the spaces through which societies expect children to be socialized towards adult norms (p.42).

This literature review accentuates the importance of designing appropriate spaces in the school environment so that children can be socialise according to recent pedagogical theory.

3.8.7 The importance of play for children's development

Piaget (1972) emphasised the interrelationship between the individual and his environment, particularly the physical environment, and its vital role in the development of the intellect in children. He saw intelligence as a special form of adaptation, consisting of a continuous, creative interaction between the organism and the environment. He divided the growth of children into various stages, starting with the instinctual responses of infancy and leading to the eventual achievement of logical adult thinking, each with its own characteristic form of play. These stages are:

- Intuitive Phase (4 to 7/8 years).
- Concrete Operational Phase (7/8 to 11/12 years).
- Formal Operational Phase (11/12 to 15/16 years).

3.9 Play behaviour and design

Children's play is immensely varied and complex. Children do not restrict their activities to places designed for this purpose, but adapt what they find to their play needs of the moment. In addition, according to Hitchmough (1994, p.500), the nature

of children's activities changes from child to child and with age. Thus, it is important to design relatively unstructured spaces for play, which can be used for a multiplicity of activities.

3.9.1 Play structure and equipment

According to Yaman (1999, p.49), the primary purpose of play structures and equipment setting, is to accommodate large muscle activities and psychomotor and human movement coordination, such as climbing, swinging, hanging, crawling, jumping and balancing. Play structures should be designed to provide a broad diversity of play opportunities and allow a wide range of behaviour options, to stimulate a variety of play and learning activities and to support the needs of children at all levels and stages of development and abilities. In addition, they should provide an environment, which caters for the non-physical aspects of children's development, such as *rendezvous* spots to stimulate social interaction; for example, natural phenomena such as logs or rocks can provide areas for socialising, where children can relax and interact.

Play equipment should be designed to support the maximum potential for creative physical action by children. Connecting paths and movement, to allow children to learn spatial concepts such as over and under, in and out, up and down, spatial depth and direction, to enable them to test their limits and to measure the risks, can increase development potential. An example of a structure that could provide this is a maze with an undulating ramp. Finally, a thematic play structure based on cultural festivals could provide a strong visual identity and clear landmarks in a play setting and therefore can assist orientation and way finding, while providing a sense of a special fun place, which belongs to the children.

The current play structures and equipment settings in Malaysia are mostly chosen and purchased from catalogues obtained from abroad, and do not reflect the local context. Though natural settings offer more opportunities for playing and learning, this is not made use of currently. The following section elaborates on natural settings as play environments.

3.9.2 Natural settings

According to Manan (1998, pp.84-86), these play environments are more appropriate for creative play than the formal playscapes mentioned above. This approach to play is not merely about running, jumping or climbing. It is also about thinking, feeling and knowing. Imaginative play settings are meant to appeal directly to children's senses. The provision of an abstract setting in a playscape will stimulate children's imagination, as this setting does not suggest usual play activities. For example, using reflexology pebbles on paths, will offer the excitement of a 'tickle'. A natural setting encourages interaction with plants and wildlife and other natural abiotic and biotic elements, to provide opportunities for direct sensory experiences. The presence of loose materials (which can be provided by a variety of small natural found objects such as insects, sticks, stones, leaves, plant parts, water and sand), will enhance the teaching, play and learning setting, to promote cognitive skills inherent in the physical environment, to solve child-initiated problems fostering self-concept development, and increasing children's opportunity to differentiate themselves from their surroundings. By using natural elements, many areas of children's cognitive development can be supported.

3.9.3 Stimulating play environment

As mentioned above, developmental needs underpin the play behaviour of children. Children require the following types of stimulation, which should be inherently available in their play settings (Manan, 1998, pp.87-89).

- *Physical stimulation.*
Examples of this type of play are running, jumping, skipping, swinging, balancing, climbing, other activities involving risk and muscular control, rough and tumble games, chasing games (hide and seek, tag etc).
- *Perceptual stimulation.*
Examples of this type of plays are dramatic play, role play, talking, telling stories and jokes, gossiping, looking after animals, music, dancing and parties.

- *Emotional stimulation.*

All children need the opportunity from time to time to be alone; sometimes they want to sit and think, to watch and to play undisturbed.

- *Intellectual stimulation.*

All play has some intellectual element; some types of play encourage it more than others. These include exploring the environment and nature, collecting (stamps, matchboxes, stones, etc), games like draughts and chess, reading, making things through following instructions and planning.

The following are four simplified categories of play behaviour as identified by Manan (1998, pp.15-19). They are:

- *Physical and active play.*

In the Malaysian context, this could include games such as hop-sotch (*teng-teng*), *konda-kondi* and *galah panjang* (field games), *sole* (rounders), marble competition, 'cops and robbers' chasing and 'hide and seek'.

- *Social and dramatic play.*

These include activities that imitate adults' (parents or older siblings) cooking, cleaning, schooling and working.

- *Creative play.*

This includes drawing, nature exploration, and kite flying competition.

- *Cognitive play.*

This includes children mapping the route to their favourite spots or acting or repeating their favourite pastime or memories.

With the incorporation of an informal curriculum based outdoors, opportunities for all of Manan's categories are available, meeting children's need for a variety of stimuli. According to Erikson (1963b), there are three main spheres of play and environmental competence for children autosphere, microsphere and macrosphere.

- *The autosphere*

This is centred on the child's own body. Play takes the form of exploration by repetitions of bodily sensations and experiments with the body such as poking the tongue out to see the reactions of those around. A child builds confidence in this world as repeated experiments and explorations lead to repeated results and the full potential of the body to create reactions and cause sensations is realised.

- *The microsphere*

This is the small world of manageable toys such as exploring the laws of the object; for example, how they break and resist construction, how they can be moved and taken away by others. Essentially, it is a 'thing world', which is mastered when manipulation of these toys is accomplished and the full play potential of these objects is realised.

- *The macrosphere*

This is the world, which is shared with others beyond mother and father. Firstly, other children and adults are treated as things as in the microsphere world, but as confidence grows, they will begin to regard others as individuals. This world is mastered when the full play potential of interacting both with the physical and human environments surrounding the child is realised.

By the time children enter primary school they have advanced to the macrosphere stage, when spaces are perceived as having both physical and social components. In this macrosphere environment, a child's environmental confidence develops not only from feelings of mastery over the physical components of the space, but also from mastery over the social ones.

By changing the way space is allocated and utilized in schools, it should be possible to produce better education outcomes. Yaman's study (1999) supports this view by suggesting that different genders prefer different types of playgrounds and both genders prefer to play in natural environments. The International Playground

Association (IPA) stresses the importance of learning through play. The *Declaration of the Child's Right to Play* (1989) observes that:

- Play, along with the basic needs of nutrition, health, shelter and education, is vital to develop the potential of all children.
- Play is instinctive, spontaneous and voluntary. It is not obligatory but is freely chosen by the player.

This view of play, in particular, reflects on the Malay primary school context, here opportunities for play at school are limited.

3.9.4 The impact of space on learning

By allocating different arrangements of space for teaching and learning, instead of purely rectangular indoor classrooms, it becomes possible to include play in the learning process. A change of the learning environment may produce more opportunities for learning by observation. Better understanding and thinking opportunities may arise from using teaching tools available in the surrounding environment (Vygotsky, 1986).

As Le Febvre (1991) and Dewey (1916) note in relation to everyday living, the lived experiences of people are a rich source of life-long learning. It has been observed that as children learn from experience, the more rich and varied this experience, particularly in terms of the teaching environment, the better their learning and life experiences will be. This is explored in more in detail in Section 3.9.5.

3.9.5 The effect of schools on children

Self-directed learners are generally more successful than controlled guided learners (Southworth, 2003). The former are more independent, in contrast with controlled-guided learners who tend to have been 'spoon fed' their education. It is believed self directed learning has more benefits for most students as it encourages free-thinking, critical analysis, and strong decision making, based on research rather opinion.

Controlled guided learners are generally more timid and will accept a group opinion rather than form their own. This means that self directed learners are more successful in achieving tasks, meeting deadlines, managing time, giving suggestions, in generating creative solutions, better at problem solving. An important part of self-directed learning is the incorporation of different learning environments in teaching;

this includes outdoor classes as an alternative to the normal indoor classroom. This distinction between learning types is important in terms of this thesis as it relates to how outdoor exposure and getting out of the 'rectangular box' can have a huge impact of space on learning.

Once learning becomes completely guided and the learning environment becomes institutionalised, learning is straightforward, dependent on the teacher and passive, rather than a playful process of enquiry. Teacher-centred learning becomes a chain, which is still what educators are struggling to escape, as described by Foucault (1970, 1980), Gramsci (1971) and Le Febvre (1991). To deal with the problem of 'dimensional' learning, educational spaces need to be more than just the interiors of buildings.

Fielding points out that there is not yet a significant body of education research in this area and further attention is required as to how school settings affect children. However, Fielding (2000, p.232), considers that:

... people internalize external restraints and prohibitions so that their behaviour is managed by varying feelings of disgust and aversion. By transferring this technique to a particular setting such as a primary school, these social prohibitions could be seen as a way of regulating and situating oneself within its social hierarchy ... some historical geographers and architects have incorporated ideas about bodily propriety, manners, discipline and morality in the context of education/schooling in their research and these warrant further attention.

Newman (1972) claims that there are relationships between human behaviour and architecture. According to Newman, the increase in crime in some housing areas in the USA is related to public spaces. His findings led to a change of housing design and policy based on Post Occupancy Evaluation (POE) research methods, investigations and results. Prescott (1998) interviewed a school principal on the issue of budget allocations in schools concerning the costs of school vandalism. Prescott's study indicates that less institutional environments, created at the school over time, fostered a pride in the students, which reduced vandalism. As an architect, she realised that the dilemma was to provide the public with the best design quality while on the other hand, meeting the other demands from the academic point of view to provide positive early environmental experiences which are strongly influenced by a

child's social and physical surroundings. The next section elaborates on how self-directed learners, who are independent, can benefit more than control-guided learners, through positive exposure to the natural environment.

3.9.6 Positive features of outdoor learning

In addition, a satisfactory solution to the problem of boredom and routine in the classroom may be found in outdoor learning in the school grounds (Southworth, 2003). As supported by Hart (1997) and Gerber (1989), cultural and gender gaps could be reduced through appropriate use of outdoor classrooms, especially for subjects such as geography. Currently in Western countries, traditional curricula are being superseded in learning, via the virtual world (Southworth, 2003). However, accessing information, identifying disinformation, misinformation or irrelevant information, are equally possible through the Internet. A teacher cannot offer the same degree of guidance or exercise control in the virtual learning world, unless with the remote control. However, the Internet offers the possibilities to extend learning (rather than teaching) by use of the virtual campus in subjects such as geography. Teachers can have a significant input into curriculum design in the 'virtual world.' Indeed this is what state of the art global learning needs, not a curriculum but a measuring stick for understanding.

Self-learning then would only be guided, rather than directed by the teacher facilitator. In the high-tech learning environment of the early 21st. century, the focus of education must change from teaching information, rote-learning and memorising, to teaching for thinking and understanding (Gardner, 1993). Less control is needed by teachers, and more freedom for intellectual discourse arising from students' curiosity. Involvement is important, rather than statements without understanding.

Recent pedagogy asserts that it is an ethical duty for educators to intervene in challenging students to critically engage with their world, so that they can act upon it and in it (Freire, 1995). Environmental learning encourages children to engage with the real world and should be seen as a teaching tool which can facilitate this process in a functional way by emphasising how environmental matters, such as environmental problems, can be related to human behavioral meaning (Finger,

1994). The gap in thinking between adults and children could be decreased by having more connection with the world outside the classrooms (Downs, 1985). Adults inhabit different geographies and children because adults impose environments on children, which restrict and direct their development, based on their age, gender, surroundings and experience of their own locality (Dewey, 1938; Kong, 2000). Jones (2000, p.30), observes that:

... this question is vital because the opportunity for children to create their own geographies, in other words, to spatialise their lives according to their own rather than adults agendas, at least to some extent, is seen as vital to their self-expression and their development.

3.9.7 Education 'in community'

More innovative design and use of outdoor classrooms could provide less restriction of students' learning opportunities and therefore encourage students to learn in an integrated way, so that learning in school would be contiguous with that out of school. For example, the education received in school should encourage future connections with the community. This is possible only when there are numerous points of contact between the social interests of the school and community. As suggested by Dewey, there are ways of increasing efficiency in action in education (Dewey, 1916). This is because children of the 21st. century need to make sense of the environmental, existential and ethical issues with which they will be faced as they grow up.

In the brave new virtual world, the borderline between reality and virtual image becomes blurred. An example can be seen by witnessing a child play a computer game, one can see how he or she becomes deeply immersed in the virtual world. Learning in the new virtual world could be transformed into *plearn* (to play and to learn equals to *plearn*) (Samuthavanji, 2001).

This approach would appear to be especially relevant to children's development in the 21st. century, particularly in highly urbanised Asian countries such as Singapore, Hong Kong and Malaysia where children are increasingly being hot-housed with computer-based education and recreation and little contact with the natural environment is allowed (Kong, 2000).

Kong, in her article “Urban Children and the Natural World” (2000, p.257), uses the rapidly urbanising state of Singapore as a case study to research urban children’s relationship with nature. This study is relevant to the Malaysian context, as Malaysian cities such as Kuala Lumpur are also rapidly urbanising, with corresponding clearing and destruction of natural areas. Kong found that while some parents realise the importance of nature in education, others tend to be overly protective when it comes to interaction with nature. This due to the ‘fear of nature’ factors, as:

... children now are too controlled. You see, in our days, children would like to climb trees and pluck cherries ... whatever there is they can do. Now, parents have one child, two children. They are so scared that they will fall down and break their heads. I mean, I have two grandsons. Their parents are so worried. They do not have the experience of being up on the tree and they are so scared. They would rather let them sit at the computer rather than let them go out and enjoy the trees and flowers. I think it’s the parents now (p.262).

Another mother contrasted her own childhood experiences of nature with those of her daughter:

... schools are now found in very built-up areas and are often not near natural areas. Children therefore have few opportunities to learn in the huge science laboratory that is the natural world. This is in contrast to [my] own childhood, when [I] learnt about the barks of trees by running into the school garden and doing bark shading and colouring (Kong, 2000, p.265).

According to Kong (2000, p.265), “children appear to have a curiosity for what they see in nature.” Her study found that contact with nature made learning more meaningful. She cites the example of a retired science teacher who uses a nearby green corridor to teach her grandchildren about natural processes, such as flowering and fruiting. She found that many children also understood the educative value of observing natural processes *in vivo*. According to two respondents, the lived experience of nature was vital to authentic learning, “Dad shows us some birds, and they’re not just all ‘birds’ like my friends think they are ... I go to school and can tell Miss Lim (science teacher) what Dad showed me, and she won’t know from the books what I’m talking about”! (Kong, 2000, p.263).

Kong states:

When I learn about fruits in the textbook, there are descriptions and maybe diagrams, but if you actually see it happening and growing, you

actually understand what you're reading. All of a sudden, it becomes real (p.264).

Several mothers and adults expressed the view that "more could be done in schools and public places to engage children with the living classroom" (Kong, 2000, p.264). As one mother suggests "parks in housing estates should have labels against trees and other plants so that children would know what they were looking at" (Kong, 2000, p.264).

Another mother reinforced the importance of realisation in children's learning, stating that they should be able to "... feel what's this leaf like, what's the shape of this leaf, why is it different from this plant ... ? I only learnt from the book, and it's not real to me. It doesn't come alive ... We should start to arouse the kind of interest and curiosity in children" (Kong, 2000, p.265).

This view is supported by an opinion from a mother living in a *kampong* (village) Malaysia:

I was born in Malaysia and grew up there. You are more exposed to nature there, so you appreciate the beauty, the nature. When we were small, we even went and caught spiders, swam in the river ... We were exposed to that kind of environment, you see. ... It's not inborn ... You learn to appreciate (Kong, 2000, p.266).

The development of spatial awareness in children is also of concern in a world where more and more children are spending their lives in highly urbanised environments children. Chase and Chi (1981) applied an information processing approach analysis to spatial cognition, which arose from Chi's work on information processing and its influence on spatial cognition. Although their work relates mostly to the nature of spatial skills in life scale environments, it identified the importance of practice and experience in developing cognitive spatial skills and the recognition of spatial elements. They refer to Lynch (1997), whose research identifies such key spatial elements as past edges, landmarks, nodes and district as most imaginable and memorable. A school and its environment is an important place where children could learn the spatial cognitive skills not available to dwellers in high rise apartments. To improve primary school environments, Lynch (1997), believes they should offer enough variety to imprint ideas. He identified key elements in this process,

considering that as part of this process, indoor and outdoor environments in schools should be able to offer an exciting and varied visual environment.

It appears that children develop their preferences for environments before adolescence. Thus, the primary school environment could be an important influence on children's ability to relate to nature. As Silbereisen, Noack and Eyferth (1986), found in their study, (which explored the leisure time preferences of adolescents in the urban area) urban adolescents' leisure activities were mostly shared between the private house, shopping centre, and swimming pool. They spent little time in other places or environments, such as parks and garden environments. Therefore, to be able to enhance the connection of children to the natural landscape, it appears essential to provide a landscaped environment in schools for pre-adolescent children, to insure that they will develop and retain a lasting connection to the environment during this time of their developmentally sensitive period.

Robertson (1994) examined the possible connections between the learning experience of student groups and their place and surroundings of living and learning. Her study refers to Luria (1970) and Das and Jarman (1991), who explored numerous cognitive functions and their correspondence to different parts of the brain. Although Luria's work is directly related to neuropsychology, some important issues were identified by Robertson in relation to the importance of the school environment to cognitive development.

Robertson (1994, p.52) found that in the relationship between people and place, there is potential for 'discovering' a connection, for example, "a connection between thinking skills and attitude to learning." The school environment and its quality represent a place and a space where young children spent the majority of their time and are therefore important to the development and learning of cognitive skills (Beer and Sheat, 1992c; 1992d).

Silbereisen and Noack (1988), in their survey, identified the aesthetic quality of nature as the most positive response category regardless of age. Conversely, the study recognised that areas deliberately designed for young people, such as

playgrounds and local parks, are usually underused (Holahan, 1978). This is because purpose designed play spaces mostly do not correspond to younger people's desires.

In terms of the successful design of school grounds and open space to meet children's needs, the above findings concerning children's positive relationship to nature and the design problems of open space should be considered. It appears that a successful school should offer valuable opportunities to interact with the natural environment, without being over-designed to produce artificial park-like playground settings.

The importance of the quality of the natural environment to humans is an issue, which has occupied many researchers in the past twenty years. According to Kaplan (1987), in his American studies on scenic quality, most people agree on the attractiveness of different landscape types. There seems to be agreement that scenery, which has had less human intervention and is more natural, with varied attributes is more attractive and stimulating. Zube (1990) and Robertson (1994) used similar techniques to those of Kaplan. The works of Zube (1990), Robertson (1994), Silbereisen, Eyferth and Noack (1986) and Kong (2000), could be interpreted as the theoretical basis for a new direction towards increasing the potential use of the school grounds by children. The school grounds could become a playground setting with sufficient freedom and background supervision, to spend their leisure time in a naturalistic environment not generally available in urban areas. This environment could also be used as part of an outdoor classroom environment allowing children to learn in a less structured, more student-centred environment.

In conclusion, this part described the history of Malaysian sociology, the influence of the British Education system and the way British school architecture changed under the influence of 20th century educational philosophers such as Dewey (1916), Foucault (1970, 1980), Gramsci (1971), Neill (1971), Lillard (1972), Piaget (1972), Makarenko (1976) and Le Febvre (1991). However, in Malaysia school design remains much the same. Although the Malaysian environment is suitable for an outdoor education approach, it has remained indoor-orientated, with little exploration of the educational potential of outdoor education. However, according to the extant literature on human geographies (Holloway and Valentine, 2000), this may have

disturbing effects on children's development in increasingly urbanised Asian countries (Kong, 2000). The research discussed in this Chapter provides a background understanding of the importance of outdoor education to the social and cognitive development of young children.

3.9.8 Summary

Present day Malaysia is a multicultural society, which offers a variety of educational philosophies in ethnic primary schools, which are influenced by traditional teaching approaches of the Malay, Chinese and Indian cultures. If Malaysia wishes to participate in the global education market, it needs to bind its multi-cultural values together to prepare future global citizens. Malaysia has not yet found a successful solution to retaining Western academic quality and efficiency of buildings, while incorporating the effective attributes of other culturally relevant models of education and architecture, such as the *madrassa*, which are based on a courtyard design, incorporating water to produce climate-responsive buildings. This review provides further support for the research questions of this research, as described in Chapter 1. Part C will review perceived human comfort research for buildings in tropical countries, as background information to inform the design of buildings and thereby improve perceived human comfort levels in Malaysian primary schools.

Part C

This Part provides background information from the extant literature about thermal comfort and the design of school buildings in Malaysia. In Section 3.10, thermal comfort is also discussed with reference to Malaysia's climate and environment. Section 3.10 of the literature review also provides a brief overview of the history of developments in the architecture of government funded primary schools. The discussion in this Part focuses on pedagogical ideas from the literature in the field of education, which can be related to environmental, and in particular, to open-air educational experiments and practices. It is not the intention in this Part to discuss in full the well-researched and documented issues of thermal comfort but rather to concentrate on pertinent issues, such as the historical background to the measurement of thermal comfort and architectural solutions to this problem. The research related to thermal comfort in tropical and hot humid climates is discussed, with particular reference to its determinants.

3.10 Thermal comfort

Generally, buildings are designed to protect humans and their belongings from extremes of climate and to provide a comfortable environment for temporary or permanent habitation. The other main purpose of buildings is the provision of safety and privacy at various required levels.

Vernacular buildings in most climates throughout the history of mankind have achieved a significant level of thermal comfort. Both the Romans and the Greeks paid attention to the climatic suitability of their buildings, as described by Vitruvius, in the 1st century (Morgan, 1960). Socrates in 400 BC had thoughts on building design to ensure climatic comfort and suitability for the achievement of improved thermal comfort levels in a Mediterranean climate by architectural means. However, according to Auliciems and Szokolay (1997, p.5), this had "very little influence on the practice of architecture". Many early Islamic buildings in Persia, the Middle East and in Southern Spain were designed and built to provide thermal comfort in hot and arid regions (Hattstein and Delius, 2000). However, during the post-classical period in Europe, safety seemed to be a more important consideration than thermal comfort and buildings were designed to withstand human intrusion, with consistently reduced

levels of thermal comfort provided. Until the Industrial Revolution, man's ability to heat and cool buildings was limited to the use of open fires, hand held fans or "the use of man made tunnels and ventilating towers in some cultures" (Auliciems and Szokolay, 1997, p.5). However, heating technology improved from the late 18th century and mechanical cooling was available by the early 20th century. In the early 19th century, Heberden recognised that not only air temperature but also humidity, contributes to thermal sensation. Haldane carried out the first serious study on comfort, with particular reference to high temperatures, in England in 1905. Thermal comfort was initially the domain of engineers. However, by the 1950s "other disciplines ... from physiology and medicine to geography and climatology" became involved (Auliciems and Szokolay, 1997, p.5).

3.10.1 Definition of thermal comfort

In 1963, a modern definition of thermal comfort was offered by Fanger (1985), as a condition where people feel neither warm nor cool. Victor Olgyay (1963), in his pioneering book *Design with Climate*, opened a new and more scientific route to the determination of thermal comfort and developed the basic guidelines to achieve it by architectural and design means in various climates. He was the first to outline the comfort zone in architectural terms as "the range of environmental conditions within which the average person would feel comfortable" (Auliciems and Szokolay, 1997, p.55).

Olgyay's model (1963), is simple but elegant and has remained the mainstay for climatic design of buildings since 1963. Olgyay's model could be considered a modern development of Vitruvius' tri-partite model of Architecture-Climate-Comfort, with the inclusion of the function of technology in the environmental scheme of modern buildings (Hawkes, 1996). A more precise definition of thermal comfort or human comfort, is that it concerns how heat dissipation and heat gain from the body varies, based on factors other than air temperature, such as metabolic rate and body mass (Auliciems and Szokolay, 1997). Clothing is "one of the dominant factors affecting heat dissipation" (p.9) and is measured in units called *clo*, for the purpose of studying thermal comfort, (as explained further in section 3.12.1).

Olgyay's 'Bioclimatic Chart' (refer to Figure 3.2) indicates the zone of thermal comfort in relation to some of the variables. This index includes ambient air temperature; mean radiant temperature (the average temperature of surrounding surfaces), wind speed, solar radiation and evaporative cooling (Givoni, 1976, p.1).

Environmental conditions in the tropical, hot and humid climate obviously present different thermal comfort issues from those arising in colder climates with four seasons. Therefore special indices have been developed to measure responses to climatic conditions particular to tropical climates (Auliciems and Szokolay, 1997, p.35) These indices and their usefulness for designing architecture in the tropics will be discussed in detail in section 3.10.3.

3.10.2 Environmental factors

Guides to climatic design for thermal comfort in buildings have been published by many researchers including Olgyay (1963), Koenigsberger *et al.* (1974), Szokolay (1980), Keumala (1992, 1996 and 1999) and Nugroho (2002).

Olgyay (1963), shows the influence of climate on building principles. He applied his results from biology, meteorology, engineering and other sciences, to climatic regions. He claimed it was theoretically possible to produce almost perfect data, using orientation, shading, building shape, air movement, site location and the effects of building materials.

Olgyay (1963), and Koenigsberger *et al.* (1974) in the *Manual of Tropical Housing Design*, provide further research in relation to tropical climates. They used the theory of climatic design and demonstrated practical results from their understanding of the theory. They analysed the effect of climate on the human body, mind, activities and way of life, suggesting technical ways of protecting the human body from climatic effects and providing specific solution for different types of tropical hot and humid climates. For example, the use of vegetations was seen as a cost-effective way to provide comfort, rather than using mechanically cooling systems. Nugroho's research (2002, p.346) also, indicated, "surrounding vegetation can help reduce temperature in buildings."

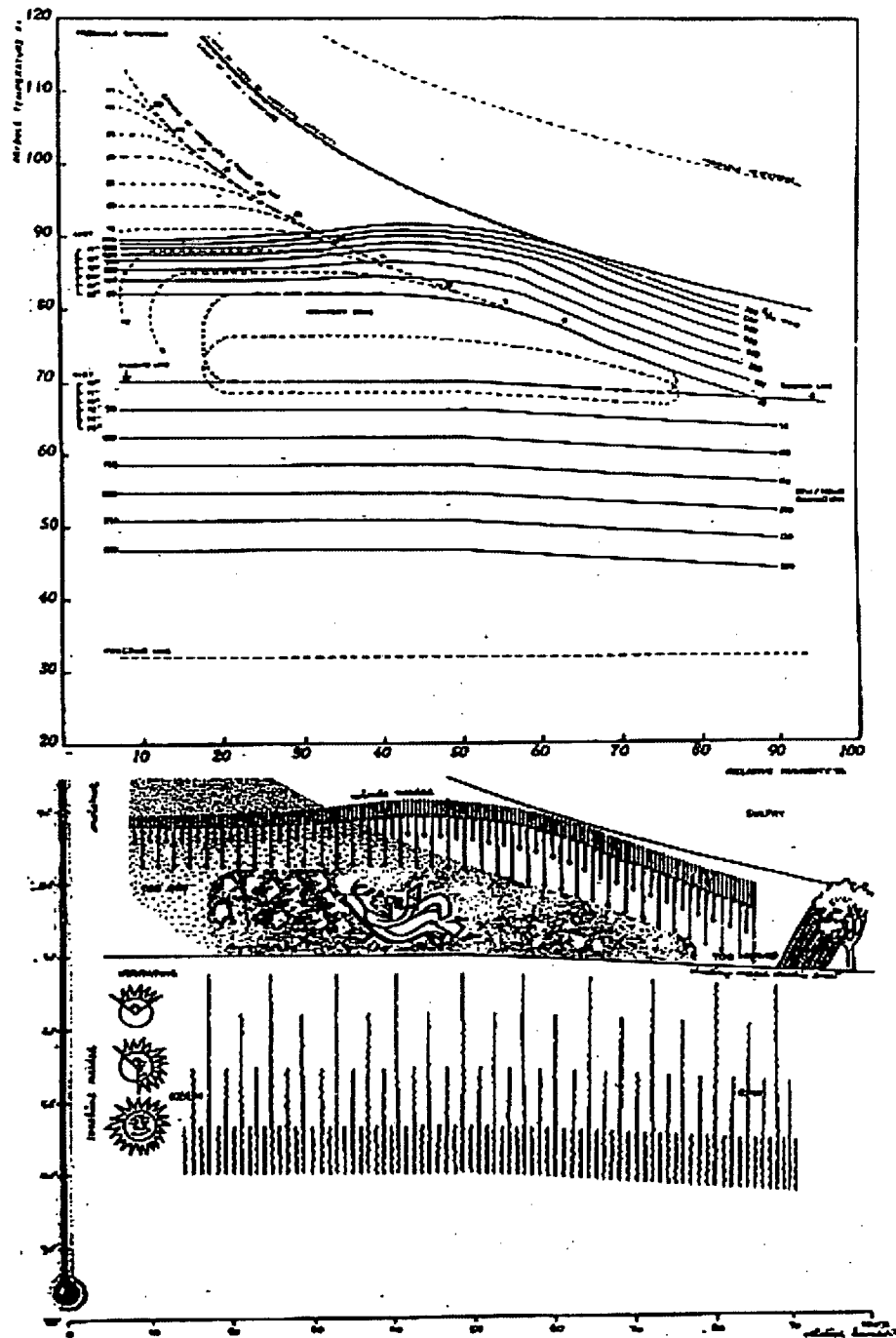


Figure 3.2: Olgyay's 1963 'Bioclimatic Chart' (Source: Auliciems and Szokolay, 1997)

3.10.3 Indices of comfort

An index is an indicator of a trend, direction or tendency (Moore, B., 2000). Indices in this discussion are related to measurement of thermal comfort, to improve perceived human comfort. Thermal comfort research with relevance to tropical

conditions has been carried out by many researchers, notably Koenigsberger *et al.*, (1974), Auliciems (1972), Fanger (1985), Bradshaw (1985), Humphreys (1978, 1992), Baker (1993), Auliciems and Szokolay (1997), Nicol (2002) and Karyono (1995a, 1995b, 1996a, 1996b, 1999 and 2002).

Fanger's (1985) work was based on the argument that when people perform their usual activities, wearing clothes that provide the same type of insulation to the body, they will find a certain temperature comfortable under the same conditions, regardless of their age, gender, size, shape or cultural-climate norm. There are six heat-balance environmental variables in Fanger's model: air temperature, humidity, mean radiant temperature, and relative air velocity, clothing insulation and activity level. However, Fanger's (1985) studies were undertaken under laboratory conditions and "inevitably specify an optimum value that is assumed to apply to all people" (Auliciems and Szokolay, 1997, p.45). Humphrey's (1978, 1992) work in contrast, is derived from field investigations, using 'real people' engaged in 'real tasks' in 'real environments' which on the contrary suggests that "people's thermal preference also has a geographical component" (Auliciems and Szokolay, 1997, p.45). These inconsistencies led Auliciems (1981, p.46) to formulate an adaptive model of thermoregulation in which:

... thermal preference is seen a result of both physiological responses to immediate indoor parameters (i.e. those measured by the indices) and expectations based on 'climato-cultural' determinants, i.e. past experience.

Auliciems and Szokolay's (1997, p.47) adaptive model has since then been investigated and verified in various locations, including Melbourne, Brisbane and Darwin, San Francisco Bay Area, Bangkok, Singapore and Townsville (refer to Figure 3.3). They state:

... the notion of a constant or static optimum is no longer an acceptable hypothesis. The comparison ... shows very different responses by people at the same location, but in (a) air conditioned and (b) naturally ventilated buildings. The observed results are even higher than the adaptive model predictions.

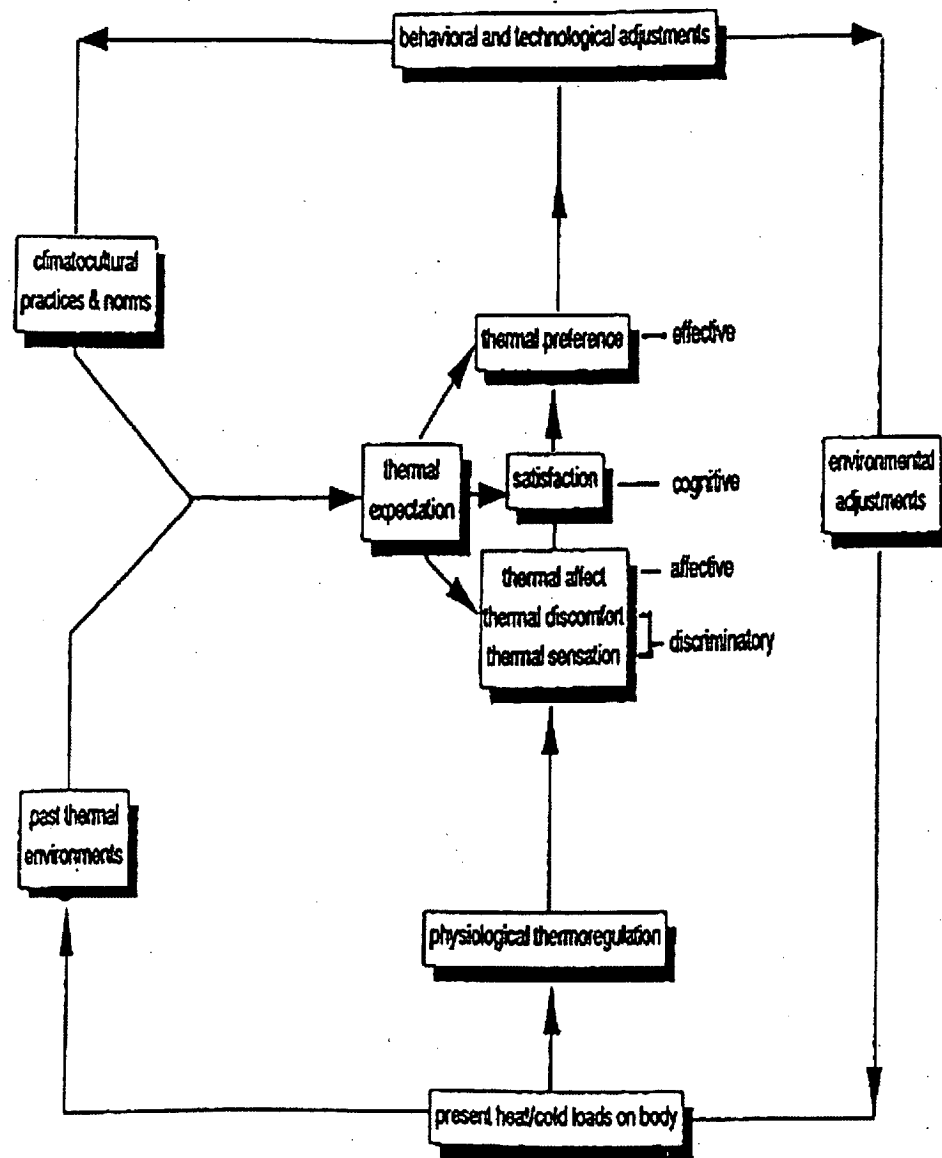


Figure 3.3: The psycho-physiological model of thermal perception: the adaptive model (Auliciems and Szokolay, 1997)

Another example of a useful index for measuring thermal comfort is the Predicted Mean Vote (PMV) index. Formulated by Fanger in 1985, this index considers factors such as air temperature, air humidity, air velocity, surface radiation, clothing condition, subject's activities and subject's perception and opinion.

However, Fanger's (1985) approach has been criticised by Auliciems and Szokolay (1997). The preferred formula suggested by Auliciems and Szokolay (1997), is $M + R + C_v + C_d - E = SW$

Where **M**=Metabolic rate, **R**=Net heat exchange through conduction and convection in radiation, **E**=Evaporation heat loss, **Cv**=Convection, **Cd**=Conduction, **SW**=Change in heat stored.

Categories included in this index include factors in the physical surroundings and individual subject conditions and perceptions. Thus, the thermal comfort level measurement obtained from this composite index is a result of the contribution of characteristics the subject's perceptions, added to a combination of the physical surroundings. An example of one such index is the 'Equatorial Comfort Index' (ECI), formulated by Webb in 1960. The index considers factors such as wet bulb temperature, dry bulb temperature, and wind velocity and subject perception.

Sometimes physical factors can be 'camouflaged' by cultural norms. Humphreys (1992) recalls a conversation between Dr Thomas Bedford, the pioneer of thermal comfort research and Charles Webb, the pioneer for thermal comfort research in tropical climates. Dr. Bedford was uncomfortable when he was in India and Webb suggested that he take off his tie and coat and wears an open-neck shirt outside his trousers. Bedford refused because of a British cultural norm, which required one to appear in public 'fully dressed.' Sometimes ways to achieve comfort are rejected, based on cultural norms that lead people to accept discomfort. People can change their surrounding built environment according to their needs, as people also design their interior and exterior spaces, to their taste in their microclimate. It can be stated; therefore, that thermal preference is a composite of physiological responses and preconceived information (experience) based on climate-cultural determinants (Auliciems and Szokolay, 1997). Comfort may be achieved by designing buildings to suit the climate according to the environmental variables, other influencing factors and human activities (Evans 1980). Comfort prediction is another method, which can aid the achievement of thermal comfort in building design; this is discussed following.

3.10.4 Comfort prediction

In the late 1970s, Humphreys correlated the results of several field-studies and developed a formula for thermal neutrality, based on a statistical average of those temperatures described by a population as neither hot nor cold (Humphreys, 1978). Fieldwork, unlike indoor climate-chamber studies, is authentic and preferable to

artificial conditions as more subjects can be involved and the results are reliable (Humphreys, 1992).

Auliciems and Szokolay (1997) reviewed international thermal comfort research by Nicol *et al.* (1994) and Karyono (1996a). The research indicated a relationship between indoor comfort temperatures (preferred temperatures) and outdoor climatic conditions. The influential factors in the external climate for indoor comfort are particularly evident in the results obtained in naturally ventilated buildings in tropical, hot and humid climates.

According to Humphreys (1978), a reading for the indoor environment is represented by mean monthly temperature T_o and thermal neutralities T_n in free running type of buildings.

This is described in a linear regression by the equation below (Humphreys, 1978; de Dear and Fountain 1994, p.112 and Givoni, 1994, p.39), where $T_n = 2.56 + 0.831 T_i$

Later the equation was changed, after the indoor temperature readings (T_i) were replaced by temperature of the ambient air (Humphreys, 1978, p.4),

where $T_n = 11.9 + 0.534 T_o$

T_n = represents neutrality in free running buildings and T_o = represents the outdoor mean monthly temperature (Humphreys, 1978).

Based on further studies for buildings not in controlled climates, Auliciems developed a formula for thermal neutrality based on Humphreys' formula. The range of readings is from 10° C to 33° C where T_o be the outdoor monthly mean temperature. This is developed into the formula $T_n = 17.6 + 0.31 T_o$ (Auliciems, 1981).

Riordan reported that the predicted mean vote of thermal sensation (based on Fanger's comfort equation) overestimates the warm discomfort feeling in tropical climates and similarly the cool discomfort feeling in temperate climates. However, thermal neutrality and preferred temperatures are not the same. As noted above, people perceive thermal comfort differently, according to geographical location (Feriadi, Hien, 2002). Karyono (1996a) found that "people in warm-humid climates

prefer up to 6° K higher temperatures than those predicted by ISO 7730,” the International Standard on human thermal comfort (Aynsley, 1996).

Thus, thermal comfort models should include relevant comparisons, which require estimation readings to be done in a real context, rather than in climate-chambers at controlled temperatures. When comparing Riordan’s work with Fanger’s predicted results, Fanger’s (1992) results do not accord with field research results, since his work does not take into account the ability of people to adapt to climate (Bromberek, 1995).

3.10.5 Acclimatisation

Recent research has indicated that acclimatisation, defined as “human adaptation strategies in response to thermal stimuli” (Auliciems and Szokolay, 1997, p.49), requires that “indoor conditions need to be harmonious with those outdoors” (refer to Table 3.1). Auliciems and Szokolay (1997, p.49) suggest that acclimatisation will be most successful when “there is opportunity and inducement for exposure to natural variability in atmospheric stimuli and when people are free to choose between the higher level strategies of thermoregulatory adaptation.” A number of human adaptation strategies to avoid effects of discomfort can be adopted in response to thermal stimuli as shown below in Table 3.1. Items (vi) and (vii) refer to building design strategies which are relevant to the subject of this research.

Table 3.1: Human adaptation strategies in response to thermal stimuli (Auliciems and Szokolay, 1997, p.49)

i.	physiological adjustments, ranging from minor vasomotor to major sweating and metabolic responses.
ii.	acclimatisation (including habituation) of both physiological and psychological mechanisms by periodic exposure to thermal stimulus.
iii.	food energy intake and dietary alterations
iv.	metabolic alterations in scheduling of activities, selection and curtailment of particular tasks or their sequencing
v.	migration, either temporary or permanent avoidance of particular stress conditions
vi.	clothing and building fabric interposition between the source of stress and the organism
vii.	external energy generation for space heating and cooling

3.10.6 Effects of discomfort on learning

In a learning environment such as at primary school, thermal stress can affect performance and capacity to work and learn effectively. According to Auliciems and Szokolay (1997, p.50):

Within the area of human performance, there is some evidence to suggest that moderate thermal stress may actually lead to improved performances in schools and within factories with heat acclimatized workers, but in general, exposure to discomfort leads to loss of capacities for physical and mental work. This has been observed in tasks of vigilance, motor coordination and dexterity and ability or perhaps willingness to concentrate.

However, controlled built environments are provided with constant temperature and humidity. This consumes large amounts of energy due to the influence of external climate factors on built interiors such as variations in radiant and ambient temperatures. An artificially controlled climate reduces human capacity to adapt and acclimatise (Auliciems and Szokolay, 1997).

According to Nicol *et al.* (1994) (based on outdoor temperatures in Pakistan), temperature standards vary with the seasons and climates. Their study demonstrates that people acclimatise themselves in order to achieve comfort by adapting to the local climate and the building's indoor climate.

Keumala (1992) carried out a Post Occupancy Evaluation (POE) of comfort in school buildings in Kuala Lumpur and the results confirmed that by the neutral criteria using the Predicted Mean Vote (PMV) (-0.5 to 0.5) during the wet season the buildings had a thermally comfortable environment in the morning from 9.00 am to 11.00 am. One school did not meet the neutral criteria at any time. It is noted that this school had minimal planting and greenery in the vicinity. Examination of the results shows the critical role of air movement and Keumala's (1996, p.613), study "suggests some simple measures that could be taken to improve the comfort environment in government school buildings."

Malaysian research such as that done by Keumala (1992) and Keumala, Ariffin and Woods, (1996), is considered to be the main source of a model for predicting thermal comfort in school buildings in Malaysia as there were no other studies of thermal comfort in Malaysian schools located in the extant literature. Much Malaysian

research has used PMV to predict thermal comfort. The prediction for the thermal comfort range in six Malaysian cities is $\pm 2.5^{\circ}\text{C}$, derived from Nicol's equation (shown in Table 3.8). A small difference of 2.5°C is a considerable achievement in tropical climates and is close to the perceived ideal comfort zone, which, according to Hall (1992), is 25°C to 27.5°C .

Three years after Keumala *et al.* (1999) conducted their study, their measurements were confirmed by comparisons of ten years of temperature data from three schools (School 1 to School 3) and a survey of the environmental comfort of users Keumala *et al.* (1999). Furthermore, in this later research, Keumala *et al.* (1999) elaborate on the interior users' personal perceptions using two objective measurements; air temperature, humidity (refer to Tables 3.2 to 3.3).

Table 3.2: Comparisons of air temperatures in 1989 and 1999 (Keumala *et al.*, 1999)

Schools	Air temperatures (Celsius)								
	1989 (indoor)			1999 (indoor)			1999 (outdoor and non-shaded))		
	Ave.	Max	Min	Ave.	Max	Min	Ave.	Max	Min
School 1	27.3	29.9	24.8	30.6	32.0	29.0	31.5	33.0	28.8
School 2	28.5	32.1	26.0	31.0	32.6	29.0	31.0	32.8	29.5
School 3	28.2	30.1	26.0	30.6	32.5	25.0	31.5	32.0	30.5
Average of samples	28	30.7	25.6	30.7	32.4	27.7	31.3	32.6	29.6

Table 3.3: Comparisons of air humidity in 1989 and 1999 (Keumala *et al.*, 1999)

Schools	Humidity								
	1989 (indoor)			1999 (indoor)			1999 (outdoor and non-shaded))		
	Ave.	Max	Min	Ave.	Max	Min	Ave.	Max	Min
School 1	68.8	84.0	54.0	63.0	86.0	54.0	62.0	86.0	52.0
School 2	75.0	93.0	55.0	68.0	93.0	57.0	65.0	83.0	57.0
School 3	77.0	90.0	66.0	64.0	90.0	52.0	63.0	79.0	54.0
Average of samples	73.6	89	58.3	65.0	89.7	54.3	63.3	82.7	54.3

These environmental factors are used as a guide to assessing thermal comfort in Malaysian primary schools in the current study. The literature reviewed below describes the application of environmental factors to inform climatic design for thermal comfort in buildings. This was used to inform the design model in this research.

3.11 The Malaysian environment

The Malay Peninsula is situated in the equatorial belt. Generally, it is under the influence of Asian monsoon weather, without a winter season (Niewolt, 1985). Malaysia is situated at latitude 1° to 10° North and longitude 100° to 119° East. The major population centre and capital city, Kuala Lumpur, is at latitude 3° North and longitude 101° East and is 17 metres above sea level. Rain falls throughout the year and daily temperature changes are slight (Niewolt, 1985). The original vegetation was tropical rainforest on most parts of the Peninsula. However, this vegetation has been cleared from the majority of the inhabited land, resulting in changed weather condition over the last 100 years.

3.11.1 Climate classification

The general climatic conditions of Kuala Lumpur are tropical, hot and humid throughout the year. The annual average temperature is around 27° C. According to Majid, Sopian and Denan (2002, p.172), “relative humidity is high throughout the year, ranging from (50%) to (99%) and with an average of (84%). Winds are generally light, with wind speed recorded between zero to three metres per second in urban areas.” Ariffin and Rao (2002, p.93), state, “the mean annual rainfall is around 2400 mm in Kuala Lumpur. December is usually the wettest month, with average monthly rainfall of 280 mm. July has the lowest rainfall, with a monthly average reading of 160mm.”

Irradiation is highest in the months between September to February, at around 6000 Wh/m² and lower in the months of March to August, at around 4600 to 3700 Wh/m² (DA Sketch Pad, Kuala Lumpur data). In the highlands, or on the west coast of Peninsular Malaysia, rain is driven by the southwest winds during the summer monsoon from April to May (Niewolt, 1985).

Kuala Lumpur is used as the representative site for this research, due to its central location, its role as the capital city and major population centre and the availability of climatic data. The school hours in Kuala Lumpur are from 7.30 am to 5.00 pm, on weekdays from January to October. According to Keumala (1992), climatic indices for school hours in Kuala Lumpur are as follows:

- Temperature: ranges between 26° C to 33° C throughout the year (refer to Table 3.4).
- Humidity: (a. m.) around (90%) throughout the year.
- Winds: zero to three metres/second.
- Rain: in the driest month (July), around 100 mm/month, during the wettest month (April) ranges around 300 mm/month.
- Irradiation: highest from January to February, ranging around 6000 Wh/m² lowest in the months from July to August, ranging around 3700 Wh/m.²

Table 3.4 shows hourly readings in a sample of three typical indoor classrooms in primary schools in Kuala Lumpur. Readings are between 25° C to 32° C. Detailed information other than Dry Bulb Temperature (DBT) is shown in Tables 3.5 to 3.7. These tables show readings for Predicted Mean Vote (PMV), Mean Radiant Temperature (MRT), humidity and air velocity. They indicate that cooler conditions in terms of air temperature can be achieved in an outdoor and shaded area. The reduction in air temperature is around 1.7° C.

Table 3.4: Indoor classroom temperatures in Kuala Lumpur schools (Source: Keumala, 1992)

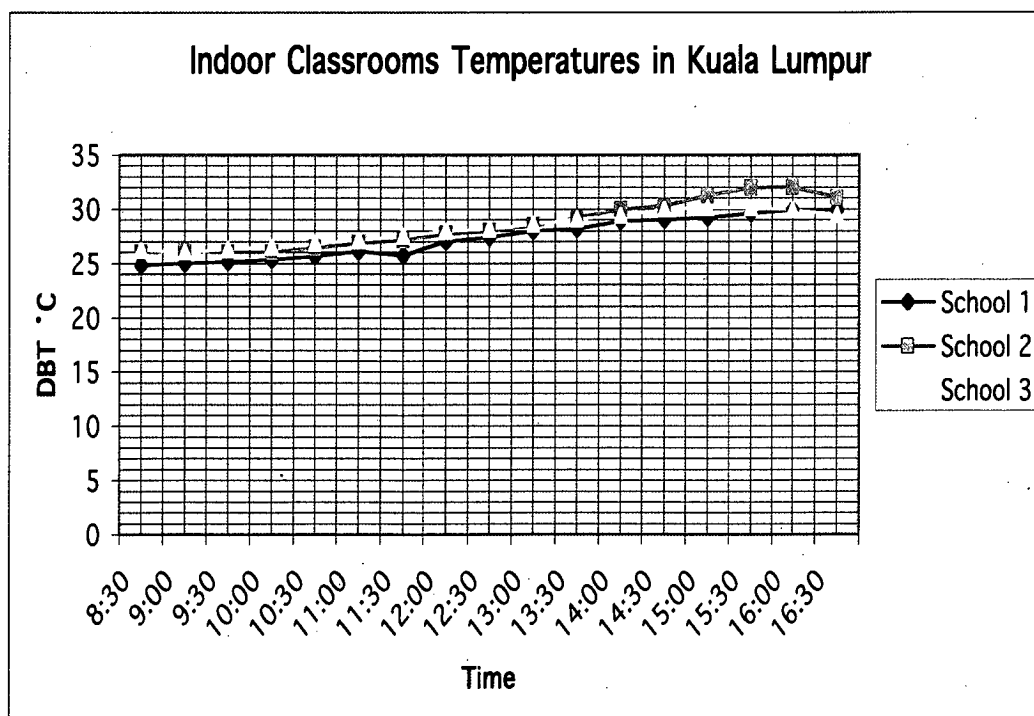


Table 3.5: Indoor classrooms' microclimatic conditions in School 1 (Source: Keumala, 1992, p.110)

Time	PMV	DBT °C	MRT °C	Humidity in %	Air velocity (m/s)
8:30	-0.51	24.8	26.2	84	0.16
9:00	0.16	25	26.4	82	0.13
9:30	0.59	25.1	27.2	82	0.11
10:00	0.25	25.3	27.8	82	0.15
10:30	-0.02	25.6	27.4	80	0.12
11:00	0.37	26.1	28.4	77	0.23
11:30	1.1	25.7	28.9	74	0.13
12:00	1.2	27	29	71	0.09
12:30	1.5	27.4	29.5	68	0.28
13:00	1.5	28	30.5	63	0.29
13:30	1.7	28.2	30.9	62	0.37
14:00	1.9	28.9	31.8	61	0.28
14:30	2	29	31.8	59	0.23
15:00	2	29.2	31.7	57	0.24
15:30	2	29.6	31.7	54	0.49
16:00	2.2	29.9	32.5	56	0.33
16:30	na	29.9	na	56	na
Min	-0.51	24.8	26.2	54	0.09
Mean	1.12125	27.335294118	29.48125	68.705882353	0.271875
Max	2.2	29.9	31.8	84	0.49

*na=not available

Table 3.6: Indoor classrooms' microclimatic conditions in School 2 (Source: Keumala, 1992, p.111)

Time	PMV	DBT °C	MRT °C	Humidity in %	Air velocity (m/s)
8:30	-0.11	26	25.3	93	0.12
9:00	-0.48	26.1	25.5	92	0.3
9:30	-1	26	25.1	90	1
10:00	0.09	26	26.1	90	0.15
10:30	-0.06	26.4	26.5	89	0.33
11:00	0.09	26.9	27	88	0.4
11:30	0.25	27.1	27.1	83	0.43
12:00	0.33	27.7	28.2	80	0.28
12:30	1	28	29.2	74	0.44
13:00	1.4	28.5	29	70	0.3
13:30	1.4	29.2	30.4	68	1
14:00	1.5	30	31.7	61	0.91
14:30	1.6	30.8	31.9	58	0.56
15:00	2.3	31.3	32.5	55	0.47
15:30	2.4	32	32.4	55	0.33
16:00	2.5	32.1	32	60	0.46
16:30	na	31.1	28.4	62	0.32
Min	-1	26	25.1	55	0.91
Mean	0.82375	28.541176471	28.723529412	74.588235294	0.45882352941
Max	2.5	32.1	32.5	93	1

*na=not available

Table 3.7: Indoor classrooms' microclimatic conditions in School 3 (Source: Keumala, 1992, p.114)

Time	PMV	DBT °C	MRT °C	Humidity in %	Air velocity (m/s)
8:30	-0.09	26.2	25	90	0.27
9:00	0.15	26	26.3	88	0.26
9:30	0.22	26.3	26.5	87	0.24
10:00	0.45	26.5	27	84	0.15
10:30	0.3	26.9	28	82	0.38
11:00	0.64	27.1	27.8	82	0.55
11:30	0.89	27.5	28.5	79	0.27
12:00	0.98	28	28.9	76	0.29
12:30	1	28.2	29.4	78	0.33
13:00	1.1	28.5	29	75	0.27
13:30	1.1	29.1	29.9	74	0.56
14:00	1.5	29.4	30.5	70	0.46
14:30	1.4	30	30.5	67	0.35
15:00	1.2	30.1	29.8	66	0.31
15:30	1.1	30.1	29	66	0.36
16:00	0.47	29.9	28.5	73	0.38
16:30	0.72	29.5	28.5	74	0.32
Min	-0.09	26	25	66	0.56
Mean	0.77235294118	28.194117647	28.417647059	77.117647059	0.33823529412
Max	1.5	30.1	30.5	90	0.15

Malaysian climatic condition are described in detail in this section in order to provide a context for the discussion of thermal comfort in Malaysian primary schools. This is then related to current school construction methods.

3.11.2 Environmental conditions in selected cities in Malaysia

According to Nicol (2002), Auliciem and Humphreys' formula (1997) was based on information from all climatic zones worldwide, while Nicol's equation was based on his Pakistan research (p.40). Since parts of Southern Pakistan have a similar climate to Malaysia, this formula was chosen for this research to predict thermal comfort in six areas in West Malaysia: the northern inland city, Alor Setar; a midland and heat island area, Petaling Jaya; an east coast location, Kota Bharu; a southern coastal town, Mersing; East Malaysian cities such as Kuching, near the Sarawak river in Sarawak state and Midland Kota Kinabalu in Sabah state. To show the variation between readings in Malaysian schools throughout the year, readings from various locations are shown here.

The locations are selected based on the density of the population. T_o = the outdoor mean temperature for the monthly mean outdoor temperature in Malaysia (refer to

Table 3.8). For example, Petaling Jaya in March 2002 at 28.7° C has a thermal neutrality of:

$$T_n = 17.6 + 0.31 (28.7).$$

Thus, thermal neutrality = 26.5° C.

T_n = represents thermal neutrality.

Table 3.8: Prediction of thermal neutrality in 6 Malaysian cities (using Nicol's formula)

Cities Monthly readings in T_n	Alor Setar, Kedah	Petaling Jaya, Kuala Lumpur	Kota Bharu, Kelantan	Mersing, Johor	Kuching, Sarawak	Kota Kinabalu, Sabah	Mean readings in Malaysia
Mar 2002	28.1	27.9	27.5	27.4	26.9	27.5	27.5
Apr 2002	27.8	27.6	27.9	27.5	27.1	27.7	27.6
May 2002	28.0	28.1	27.9	27.5	27.4	27.7	27.8
June 2002	27.7	27.8	27.8	27.3	27.2	27.5	27.6
July 2002	27.5	27.8	27.8	27.2	27.4	27.7	27.6
Aug 2002	27.4	27.5	27.5	27.1	27.1	27.5	27.4
Sept 2002	27.2	27.6	27.4	26.9	26.9	27.3	27.2
Oct 2002	27.3	27.6	27.4	27.2	27.0	27.3	27.3
Nov 2002	27.2	27.2	27.1	27.1	26.9	27.3	27.1
Dec 2002	27.5	27.4	27.4	27.1	27.1	27.5	27.3
Jan 2003	27.5	27.4	27.2	26.9	26.8	27.2	27.2
Feb 2003	27.8	27.6	27.2	27.2	26.9	27.3	27.3
Minimum	27.2	27.2	27.2	26.9	26.8	27.2	27.1
Yearly Mean	27.6	27.6	27.5	27.2	27.1	27.5	27.4
Maximum	28.1	27.9	27.9	27.5	27.4	27.7	27.7

*Based on data from meteorological department (<http://www.kjc.gov.my>).

3.12 School building in Malaysia

In tropical Southeast Asia, thermal comfort has traditionally been achieved by designing buildings with wide, shading roofs, elevated and ventilated floors and openable or part-opened walls to allow for cross-ventilation (Yaman, 2002).

However, during the colonial era, building design was a direct application from English architecture, without considering local tropical vernacular architecture and its ability to meet local thermal comfort needs. In addition, there was no consideration of external environmental factors, which might affect perceptions of

thermal comfort by the buildings' users. For example, the first public school buildings in Malaysia were built in the Victorian era. They reflected the disregard of the Victorians for climatic thermal comfort in the tropics, as did the unsuitable heavy clothing of the Victorian colonists. This has resulted in poor levels of perceived thermal comfort in Malaysian government buildings, such as schools, built from the colonial era to the present (Keumala, 1992). To a large extent, this remains the case in present day Malaysia, as described in Chapter 2.

Currently, in Malaysia, school buildings in the English comprehensive school style are still being constructed, with mechanical cooling systems and little awareness of Sustainable design principles (Seaborne and Lowe, 1977).

Some locally developed colonial building types proved to be more successful in this climate, such as the Indian or Australian bungalow with its 'breezeway' and wide overhanging verandah roof. These buildings were often built on an elevated floor platform (Ahmad, 2003). However, most colonial buildings, in particular public buildings, were copies of Portuguese, Dutch or English buildings, which performed poorly in the wet tropics.

The contemporary construction of standard Malaysian school buildings does not fully follow the principles recommended for naturally ventilated buildings in hot-humid climates (Olgyay, 1963). Roofs are usually coloured concrete tiles with reflective aluminium foil insulation only. There are usually some attempts towards natural ventilation, but classrooms remain standard, opening usually from an open air corridor with a set of standard windows. The buildings are typically constructed with a concrete post and beam structure with single, rendered clay brick and non-load bearing walls (Wan, 2000) (refer to Figures 3.4 and 3.5).

Insulation is not used in the walls. Floors are usually 150 mm thick suspended concrete floors. The standard urban school buildings are two or three storeys high but rural schools can be one or two storeys high. Roof overhangs are relatively small but the roof of the open corridors usually produces adequate wall shading for part of the building walls. There is no evidence of conscious site design efforts to use landscaping, including trees, to shade the building walls and to channel site breezes.

Hard materials, such as tarmac and concrete pavers, usually cover much of the school grounds, storing and radiating heat (Ahmad, 2003). Awareness of thermal comfort issues and environmentally sustainable design principles are important factors affecting the achievement of thermal comfort in tropical buildings. Recently, innovative building design by local architects such as Hamzah and Yeang, has focused attention on the provision of thermal comfort in office buildings in urban Malaysia (Ariffin and Rao, 2002).

However, the Malaysian government has not yet adopted these approaches fully in the design of government buildings in general, or schools in particular. Hamzah and Yeang's work is seen as an experimental building innovation in Malaysia, whereas in Western countries it has been more widely acclaimed for its ESD features which also improve thermal comfort (Baird, 2001). It is hoped that this research will add support to the growing interest in providing climatically appropriate local design solutions to building in tropical hot and humid climates, particularly in Malaysian primary school design.

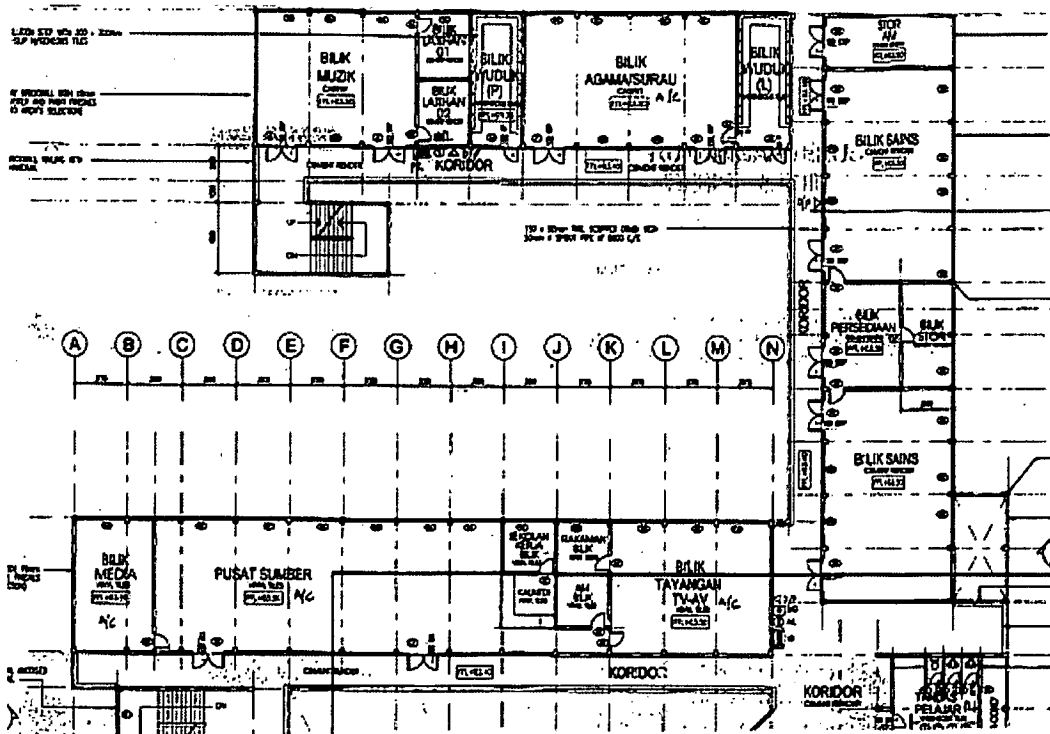


Figure 3.4: Typical Floor plan of standard government funded primary school (Wan, 2000).

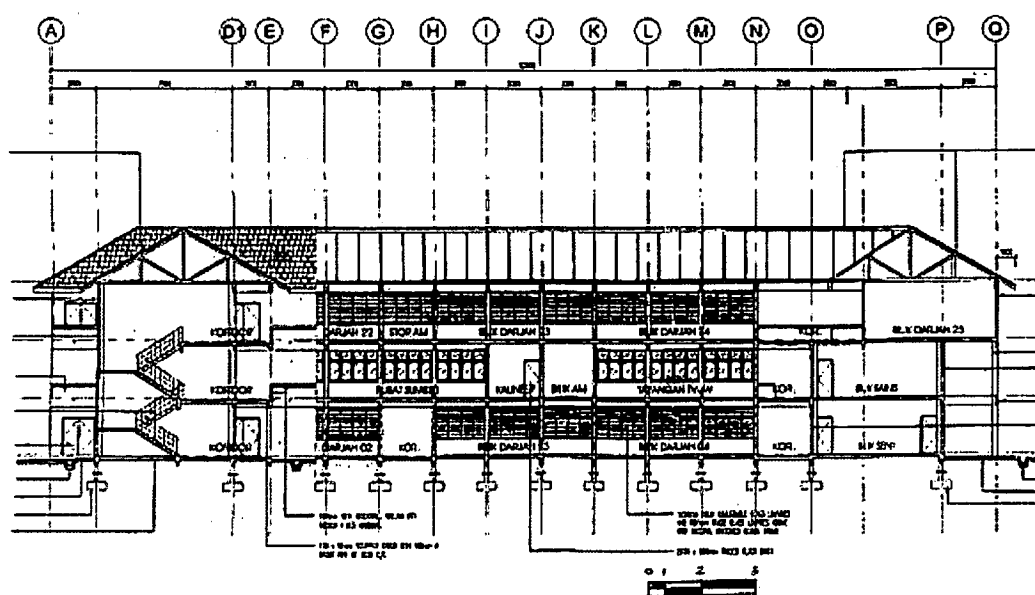


Figure 3.5: Section showing construction and building material of the school (Wan, 2000)

3.12.1 Individual factors affecting thermal comfort

People can tolerate some discomfort in the surrounding climate by means of psychological adaptation and individual resilience (Baker and Standeven, 1994). The most important personal factors affecting thermal comfort are the metabolic rate (activity) and clothing and individual acclimatisation. This can take from twenty minutes to more than six months in a particular environment. Other contributing factors are body shape and subcutaneous fat. Age and gender are also important factors affecting thermal comfort. (For example, older people) have a smaller tolerance range for high temperatures and women generally prefer a temperature of 1° C higher than men, considering the clothing differences (Auliciems and Szokolay, 1997).

Imposed colonial cultural norms can also affect thermal comfort in colonial environments, such as Malaysia, where British dress codes persist. For example, Table 3.9 shows that male civil servants, including teachers, wear extra clothing such as socks and long trousers at work, irrespective of the temperature. In certain schools, it is compulsory for male teachers to wear a necktie while teaching, which adds to thermal discomfort in hot tropical climates. Traditional clothing such as

round collared shirts and shorts are banned as school attire in all Malaysian schools, whereas if they were allowed, teachers and students would be more comfortable. Additional garments worn by Muslim teachers include light material such as the cotton headgear *hijab* for females and the *kufia* for males. Other than light and airy garments, colours of clothing such as light colours increase thermal comfort. The insulating value of teachers' clothing is shown Table 3.9 below:

Table 3.9: Insulating value of clothing elements based on ASHRAE 1985 (Auliciems and Szokalay, 1997, p.9)

Male Teacher	Clothing	clo	Female Teacher	Clothing	clo
Undergarments	Singlet	0.06	Undergarments	Bra and panties	0.05
	Briefs	0.05		Full slip	0.19
Shirt	Light, short sleeve	0.14	Dress	Light	0.22
Trousers	Light	0.26			
Socks	Ankle length	0.04	Stockings	Any length	0.01
Footwear	Shoes	0.04	Footwear	Shoes	0.04
Total clo for male teacher		0.59	Total clo for female teacher		0.59

The overall effect of clothing is not dramatic in a temperate climate but it is possible to achieve a reduction of 2.5° C with suitable clothing, which is a considerable achievement in a tropical climate. This is close to the perceived ideal comfort level in tropical regions such as in Kuala Lumpur, Malaysia, as noted in Karyono's (1996a and 1996b) Indonesian study, dealing with a hotter tropical climate than that of Malaysia.

3.12.2 Recent research into human comfort in tropical buildings

Hawkes (1996, p.30) asked four questions in relation to the environmental conditions of teaching spaces of five primary schools in Essex. These questions can also be usefully applied to researching conditions of thermal comfort in tropical school environments. They are as follows:

- What is the potential for variation of environmental conditions, which is offered by buildings of different types?
- To what extent do the occupants of buildings take steps to modify the environment and at what point?
- How wide is the range of conditions which is tolerated?
- Does this 'toleration' demand changes in activity patterns?

Hawkes investigated thermal comfort in temperate climate schools in England but due to the general nature of the questions they can be useful for analysing tropical school conditions as well. This research will examine standard Malaysian schools and the research proposals using Hawkes' (1996) questions as a framework.

There are relatively few direct studies of thermal comfort conditions in tropical schools. The literature in this area relevant to this research is summarised below.

Siddique (1977) researched and proposed design considerations for rural primary schools in various climatic areas of Pakistan. His work, *Design considerations for construction of rural primary schools*, was carried out for the Bureau of Education Planning, Ministry of Education, and Government of Pakistan and was released as a limited circulation government publication in April 1977, in Islamabad.

His architectural recommendations for hot-humid climate schools were as follows:

- Radiation control: Light and reflecting exterior roof surfaces and vegetation to be provided above the height of ten feet (3 metres) in the form of trees.
- Air temperature: Negligible factor (little change).
- Humidity: The presence of water and low vegetation is to be avoided and maximum air movement is to be provided.
- Precipitation: Varies from climate zone to climate zone.

In addition, Siddique (1977) recommends an elevated floor to assist cross ventilation (refer to Figure 3.7).

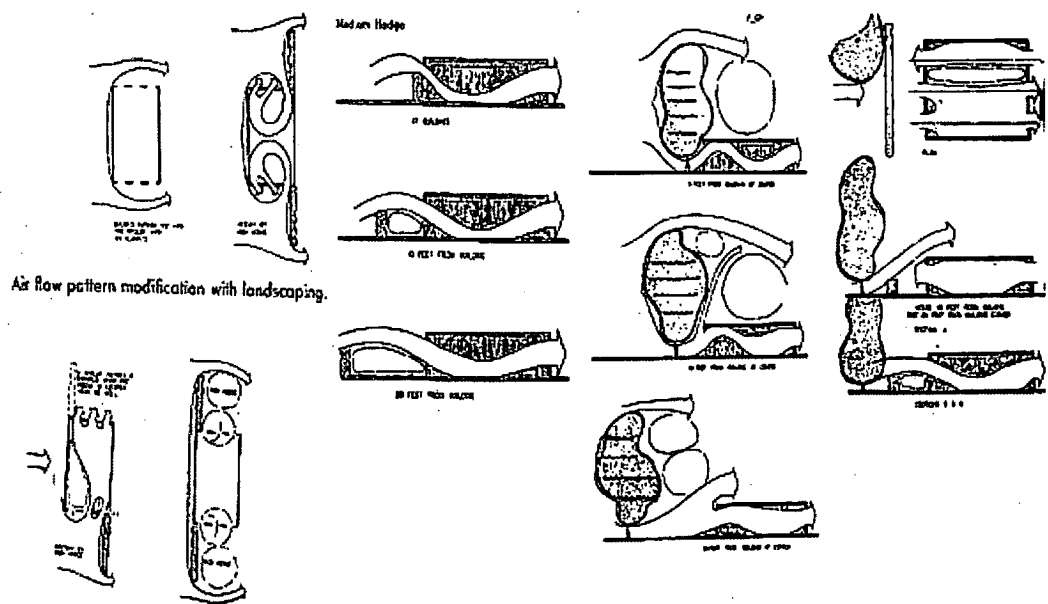


Figure 3.6: Olgyay and Olgyay, 1963, p.102

Siddique’s free flow ventilation conceptual diagram (1977) is comparable with Olgyay’s (1963) and Fry and Drew’s (1964) conceptual recommendations for hot-humid climate buildings. Another important aspect of Siddique’s work is his recommendation to build ‘open air’ schools in rural Pakistan, with a single lockable storeroom and open-sided, shed-like classrooms in a fenced or walled landscaped compound of forty metres by forty metres (120 feet by 120 feet) (refer to Figure 3.7).

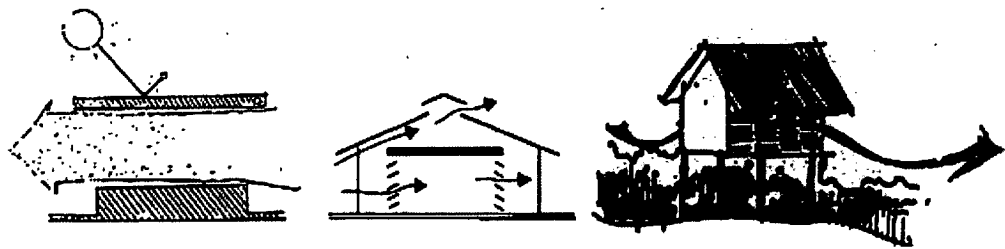


Figure 3.7: Siddique 1977, p.105; Szokolay 1980, p.331 and Harris and Welke, 1982

The most recent research on the sustainability of the built environment in the tropics is documented in the proceedings of an international symposium on the subject in Jakarta (Karyono, Nicol and Roaf, 2002). There were a number of papers published in the proceedings with direct implications for this research topic and they are discussed below.

Nicol (2002, p.40) questions the accuracy of the International Standard for indoor climate, (ISO 7730) based on Fanger's Predicted Mean Vote or Predicted Percentage Dissatisfied (PMV / PPD) equation, as it is applied to tropical climates. He concludes his paper with the suggestion that "PMV fails to give accuracy in tropical conditions about the temperatures which people will find comfortable" (Nicol, 2002, p.40).

Following the field surveys in the tropics, Nicol, Humphreys, Webb and Nicol (2000), state that PMV predicts that 'people will feel hotter than they actually are' in tropical climates. He recommends that a comfort zone variation of 2° C to 3° C is acceptable. Nicol (2002, p.47) also suggests that "if fans are available to building occupants another 2° C or 3° C can be added to the predicted comfort temperature in the hottest time of the year."

In addition to the surrounding temperature, building material is another important factor to consider when discussing thermal comfort.

3.12.3 Buildings and comfort

Satwiko (2002, p.84) calls attention to the importance of the roof in reflecting solar radiation. He recommends an extremely highly reflective material for roofs, which will reflect much of the solar radiation before it is absorbed and converted to heat. Although Satwiko's research is mostly aimed at the larger scale reduction of urban heat islands in hot climates, his work has some relevance to this research as it emphasises the importance of roofing material in open sided classroom buildings.

Ariffin (1994, p.3) conducted a comparative measurement and thermal comfort survey in a suburban area of Kuala Lumpur in a double storey terrace house typical of contemporary design in Malaysia and in a traditional timber house found in a rural village. Whilst the sample (only 2 buildings) is limited and therefore requires the results to be considered with caution, the measurements were taken over a long time span and the buildings were in comparable settings of microclimate. The results showed that the traditional building enjoyed a mean indoor air temperature 2.5° C lower than the contemporary terrace house. Ariffin also found that measures for Predicted Percentage Dissatisfied (PPD) were higher for the terrace house, except during the night, whilst remaining comparatively low for the traditional house throughout the completely twenty four-hour period.

Her Climatically Sensitive house design research reflected the superiority of traditional planning and design details, with a mix of traditional and contemporary building materials. The resultant heat load simulations suggests that this hybrid solution has a mean indoor air temperature of about 1° C above outdoors air temperature, which represents a 1.5° C advantage over the contemporary terrace house. The cost of achieving this advantage is estimated at a (20%) increase in the cost of construction of the traditional house.

However, building materials and openings are not the only ways to achieve thermal comfort. Vegetation also plays a role in reducing heat, as described below.

3.12.4 Cooling built environments with the use of vegetation

Purnomo (2002, p.460) studied the effects of vegetation on air temperatures on campus grounds. His work refers to earlier studies by Emmanuel (2002) who examined the impact of vegetation of microclimate on 'heat-islands', which showed that:

- Vegetation, especially trees, could shade certain areas from sun and reduce the air temperature (Sheffield and Westerling, 1997; Santamoris, 2001).
- Appropriate vegetation placement could reduce power loads by 30 percent (Ball, Erickson, Garbisch, 2002).
- Vegetation could reduce air temperature on asphalt surface by 2.2° C (CUFR, 2002).

The above findings demonstrate that vegetation has a positive influence on reducing air temperature.

Purnomo's study (2002) indicates that there is a significant relationship between vegetation and air temperature. His results show that there is also a significantly positive relationship between air temperature and certain surface types in both campuses studied at Trisakti University in West Jakarta and ISTN in South Jakarta. He found that asphalt surfaces increase air temperature significantly in comparison with grass and gravel surfaces. The study also indicates that there is a positive relationship between wind speed and vegetation, if trees are positioned in order to channel wind flow.

Mohyuddin and Yusuf (2002, p.494) in their examination of the characteristics of the traditional Malay cultural landscape found that traditional Malay society used to pay very careful attention to how a building site sustains the relationship between man and the natural environment. They also called attention to the traditionally close relationship between indoor and outdoor spaces and their visual environment.

Ariffin (1994) and Pramujadi (2002) found that a combination of vegetation and certain types of building materials could achieve a better indoor environment in buildings. Pramujadi (2002, p.471) investigated the potential climatic effects of vegetation in both the urban and the micro climatic scale in the warm humid tropics. Pramujadi advocates the method of 'balanced cooling' for tropical urban areas, by which he means creating a balance between outside and inside temperature. This can be best achieved by cooling the surrounding area of the building through vegetation shading. Pramujadi emphasises the importance of roofs in tropical architecture. Current roofing materials, such as concrete or clay tiles, can both contribute heat to the interior of a building and add heat to the exterior environment. Air-conditioning can further increase the outside heat and this contributes to the urban heat island phenomenon. He advocates the use of both outside shading of the building surrounds by trees and the use of vegetation on the roof (living green roofs), as a means to create sustainable and low energy use architecture in tropical regions.

Other than vegetation and building materials, environmental factors such as wind and shade are another means to achieve thermal comfort as, described below.

3.12.5 Vegetation and comfort

Ariffin and Rao (2002, p.100) emphasise the importance of both plants and traditional building types and materials in providing optimum levels of thermal comfort. According to the authors, in hot-humid climates, lightweight built forms with permeable walls and elevated permeable floors and large roofs are the most suitable building types to provide thermal comfort in the hot-humid tropics. Following Yeang's (1999), experiments with vegetation-screened vertical walls in the Mesiniaga Tower in Kuala Lumpur, Ariffin and Rao (2002) emphasise the importance of both plants and grasses to reduce the heat load on exposed surfaces by noting that: "experiments showed that radiation can be reduced up to 63 percent

under vegetation shaded surfaces on bare ground temperatures, which can be reduced by as much as 22° C in five minutes after the arrival of the shadow line”.

3.12.6 The effectiveness of vegetation in absorbing heat

Canadarma and Jusuf (2002, p.448) investigated the effectiveness of vegetation in creating an improved human environment in hot-humid climate urban areas in Indonesia. The authors examined Robinette's (1983a) recommendations regarding “sun absorption by shade trees, effect on air temperature by vegetation and effect on ground temperature by vegetation.” Robinette (1983b) edited and published a major work with McClemon for the Centre for Landscape Architecture Education and Research in the United States. This work was mostly based on his own research published in *Landscape Planning for Energy Conservation*, which has remained a key work to date on the effects of landscape on microclimatic conditions. According to Robinette (1983a, 1983b), shading by trees can prevent as much as (70%) of the sun's heat from being absorbed by the ground and 5.5° C to 11° C, due to shading when the general temperature is 32° C, can cool air temperature. The ground can receive less than (20%) of the incidental solar radiation in forested areas and grass covered surfaces are (33%) cooler than paving exposed to the same amount of solar heat. In addition, Canadarma and Jusuf's (2002) work fully endorses Robinette's ideas and makes a number of recommendations for hot-humid climate landscapes (refer to Figures 3.8 to 3.11).

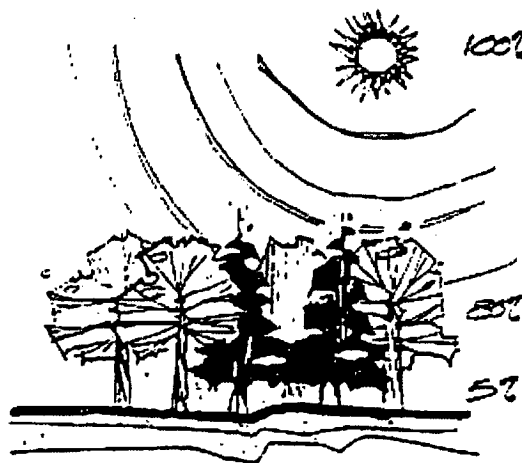


Figure 3.8: Effect of vegetation on ground temperature in the forest (Robinette, 1983b, p.23)

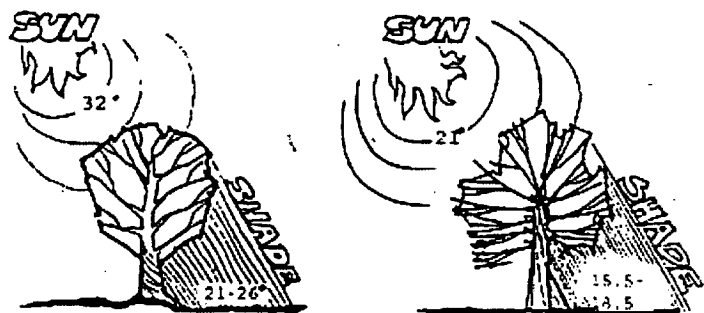


Figure 3.9: Effect of vegetation on air temperature (Robinette,1983b, p.23)

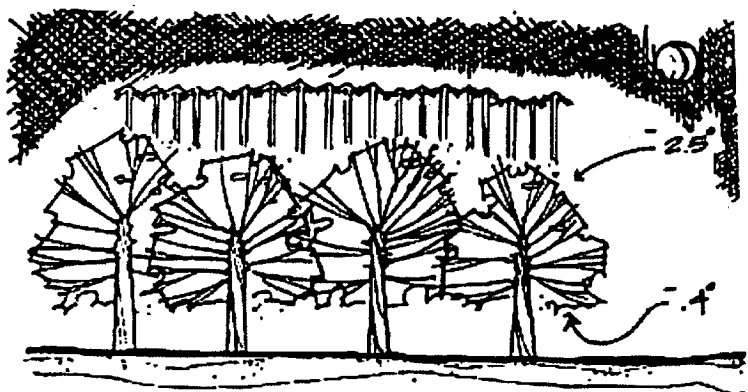


Figure 3.10: Cooling effect of vegetation (Robinette, 1983b, p.24)

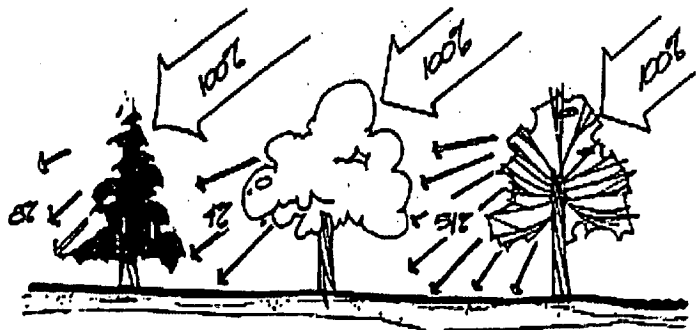


Figure 3.11: Cooling effect of many types of vegetation (Robinette, 1983b, p.25)

3.12.7 Species of plants, which can be used to reduce air pollution

There are many species of plants, which can be used to modify air pollution. Mediastika's (2002, p.481) research on climbing vegetation for shade and spreading particulate matter in buildings to reduce air pollution, found that dispersion of particulate matter is mostly at lower atmospheric layers and that particulate matter could be deposited on certain types of vegetation. Low growing vegetation or

climbing plants with particular leaf conditions that encourage deposition were predicted to be suitable for this function. Four species were examined; *Duranta repens*, *Polyscias fruticosa*, *Stephanotis floribunda* and *Scindapsus sp.* In the preliminary study, no valid conclusion could be drawn from this experiment. However, there are indications that *Duranta repens* and *Stephanotis floribunda* block and deposit slightly more particulate matter than the two others are. The fine hair on the surface of leaves with a rough surface, are better at absorbing fine particle matter, compared with smooth surface leaves.

Mediastika's (2002) finding is supported by a case study done by Kusmaningrum (1997) in housing estates on a main road at Jalan Padjadjaran (Bogor) and in Cinere (Jakarta). Her research concludes that the planting of vegetation, such as certain trees and shrubs, could reduce the presence of Nitrogen and Sulphur in the air.

Dockery and Schenker (1993) state that reducing the presence of pollutants in air is important, as pollution can cause chronic diseases such as bronchitis, asthma and pneumonia. The effort to reduce pollution by reducing gas emission levels is important in order to reduce the level of fine particulates.

3.12.8 The effect of shade on human perceptions of thermal comfort

Majid, Safian and Denan (2002, p.171) have carried out research in Malaysia in relation to the microclimate of courtyards in tropical regions. The authors carried out field research in a number of shaded and non-shaded areas in the grounds of the International Islamic University of Malaysia in Kuala Lumpur. They found that there could be as much as 4.3° C difference in air temperature, reflecting the difference between shaded and non-shaded parts of the same courtyard. The relative humidity is, however, increased by as much as (15%) in the shaded areas. Fully enclosed courtyards (with open corners) were the most effective in temperature reduction as the open corners allowed air movement. Additionally, the authors suggest a wind velocity between one to two metres per second as the most favourable to offset body heat.

The effect of wind speed can help to achieve thermal comfort outside the building, as described earlier. Its effects on thermal comfort within the building are described below.

3.12.9 The effect of wind speed on the achievement of thermal comfort

Hien and Tanamas (2002, p.192) describe a chamber experiment devised to determine the effect of wind speed on thermal comfort in a Singaporean naturally ventilated environment. The study found that air movement is a “common, most important parameter affecting thermal comfort and thermal sensation”. The researchers also found that Predicted Mean Vote (PMV) model predictions closely followed the Thermal Sensation Vote (TSV) values in conditions without cross-ventilation. However, above two metres per second air movement, the PMV model could not predict the TSV accuracy. In these cases, the PMV considerably under-predicted the TSV values.

Hien and Tanamas (2002) describe the differences of opinion about the relationship between wind and thermal comfort in the building. The following authors describe the differences in the surroundings of the building to provide future design suggestions for buildings which can achieve better thermal comfort levels.

Rijal, Yoshida and Umemiya (2002, p.243) investigated thermal comfort in indoor and semi-open spaces in Nepal. The investigations concentrated on the establishment of neutral temperatures in a sub-tropical climate, using the method as described by Nicol *et al.* (1994). The authors obtained a neutral temperature of 33° C for sub-tropical climates, compared to 23° C to 29° C in temperate climates and 21° C in cool climates. They also found that the neutral temperature was higher in the semi-open spaces in the sub-tropical climate and the temperate climate, both in summer and in winter, than those in the indoor spaces. Semi-open spaces in the Nepalese context of this study were open verandah-like structures, usually attached to buildings. The elevated timber frame is constructed with a timber plank floor. The elevated deck is usually more than two metres above the ground to reduce humidity under the building. The walls are vertical teak boards and roofs are built with various materials, such as wood shingles, slates and clay tiles. Their research concluded that the buildings would perform well in the region of Kalimantan, where the constant sea breeze would aid the circulation of cooler air through the building. In inland central Java, these buildings do not perform as well. They represent a cultural heritage more than a climatically appropriate vernacular building.

3.12.10 Cost saving of climate design in building

Prescott (1998) summarises the thermal comfort needs of tropical schools. She refers to the Watson and Labs work (1983, p.26), which states, “the objective of the climatic design of buildings is to reduce the budget spent for energy used to achieve thermal comfort in the buildings.” The maintenance costs and energy used to provide thermal comfort increases when there is no heat balance between a human body and its surroundings. The body produces heat by its activities and metabolism. Body heat is exchanged with the surrounding environment by conduction (contact), convection (air movement), evaporation (of moisture at skin surface) and radiation (Watson and Labs, 1983).

3.13 Conclusion

The review of the literature, which describes recent research into the tropical human comfort zone, identified a number of important issues for this study. They include the human comfort zones for tropical and hot-humid climates specified in the work of Olygyay (1963), Koenigsberger *et al.* (1974), Fanger (1985) and Auliciems Szokolay (1997) and others and the lack of accuracy of the temperate climate established Predicted Mean Vote (PMV) values when applied to tropical climates. Nicol (2002, p.47) suggests that 2° C should extend the tropical comfort zone to 3° C above the temperate optimum and further extension may be justified with adequate air movement. Nicol (2002, p.47) also suggests mechanical ventilation indoors. Karyono (1996a) suggests a 6° C higher upper limit for tropical climates.

Keumala's (1992) research found that conventional Malaysian school classrooms seldom achieve a thermally comfortable environment, beyond the morning period of 9.00 am to 11.00 am. Several authors suggest that better thermal comfort conditions can be provided in the tropics in shaded and well-ventilated spaces, such as open-air space. The estimated and measured temperature reduction in these spaces compared to enclosed indoor spaces varies, according to the researcher, from a minimum of 1.7° C to 4.3° C. In addition, suitable clothing can achieve a 2.5° C perceived temperature reduction. Several authors such as Satwiko (2002) and Robinette (1983a, 1983b) agreed on the principles of design and construction for suitable, naturally

ventilated buildings to provide thermal comfort in hot-humid climates. The factors include a reflective and insulated roof, an elevated and ventilated floor, large wall openings to allow cross ventilation, shading of the walls and roofs with trees and climbers, and landscaping to allow and aid on-site air movement. In addition, several authors suggested the importance of ground shading by low vegetation cover over the majority of the site. Lawns and low ground cover below the building deck level are recommended. Hard surfaces should also be shaded by trees. There are clear indications in the literature review of the importance of site design and building location and orientation on a site to achieve the maximum benefits of natural site air movement.

3.14 Summary

Chapter 3 presents an overview the literature in three parts, highlighting the socio-cultural history of Malaysia as it applies to global educational thinking. It has provided the context for an additional review of the architectural design features for schools, linking architectural design of schools to an educational philosophy that embraces nature in outdoor spaces that arguably has not being part of Malaysian policy for centuries. If pedagogy were to include features of religious philosophy, rather than remaining in a 19th century instruction-centred approach to education, nature could provide a virtual university, when combined with on-line teaching and learning procedures. These principles could also influence architectural approaches to the design of primary schools in Malaysia in future.

The innovative approach of this research involves the revival of these traditional ideas for the design of educational spaces in the 21st century. Hence, the research questions for this research are based on the findings of the literature review. The research revolves around how to develop a more appropriate primary school model that considers Malaysian climatic conditions and environmentally sustainable design principles. This involves using external landscaping following the principles of existing non-European models (such as the *madrassa*), which offer cost-effective benefits to users (students and teachers) and optimise health, comfort and improved learning outcomes. Hence the hypothesis that the increased use of outdoor teaching

and learning spaces will contribute to improved school environments in the hot and humid tropical climate context of Malaysia.

In Chapter 4, the Research Design for the investigation of this complex issue is outlined.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

The objective of this chapter is to describe the methodology used in this study. This chapter is discussed in the following sections: **Research Design** (which incorporates methodology); **Ethics, Reliability and Validity**; **Data Collection**; **Data Classification**; and **Data Analysis**. In Chapter 1, it was hypothesised that increased use of outdoor teaching and learning spaces will contribute to improved school environments in the hot and humid tropical climate context of Malaysia. From this hypothesis, two research questions were developed, which are approached in an Islamic constructivist manner. For the purposes of this study, 'outdoor classrooms' are defined as spaces that have a roof, adequate floor and semi-open side panels (Yaman, 2002). The research questions are:

Research question 1: What is the nature of current teaching and learning spaces in government funded primary schools in Malaysia?

Research question 2: How can alternative models of school learning and teaching spaces assist primary school environments in Malaysia?

In order to develop an appropriate and sympathetic research design, Malaysian history was researched "to discern the concepts, plans, methods and reasons which have produced building as it is today" (Dewanto, 1997, p.16). Through an understanding of society, culture, behaviour and beliefs, an awareness of the influences that have produced the present day Malaysian education system and its architecture can be achieved. The cultural-historic tradition of Islamic philosophy and learning are strongly adhered to this research. The research questions and the resulting research design involve a number of areas and disciplines, including historical and cultural issues, education, architectural science, construction and landscape architecture, all of which are related to the Malaysian context. A singular research method was deemed to be inappropriate for the complex nature of the problem. Therefore, the use of more than one research method and relevant data types are used to address the research questions.

In this study questionnaires and group interviews were used to seek the opinion of reliable sources, such as current building users, teachers, building professionals involved in designing schools and education administrators. In order to test the validity of the hypothesis a sampling of opinions from building professionals was obtained. This sample (n=6) comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer, and a Ministry of Education officer. Thirty six schoolteachers (n=36) were also interviewed for current views of needs in education spaces, using a questionnaire and in-depth interviews.

A substantial amount of substantive and methodological data has been gathered in this study, which either broadly or specifically addresses the research questions. Due to this, and the complexity of investigating practical design aspects of educational settings while also considering educational values and beliefs, the two research questions are broken down further into five Investigative Issues. These Issues have allowed a focused, yet inclusive, approach to the wide range of factors which impact on this study. Addressing these Investigative Issues, in response to the research questions, has resulted in the generation of three Key Assessment Criteria. Stakeholders and building professionals required these criteria for the purpose of testing the Study Model and generating research guidelines for future use. This is due to the problem involving practical design aspects of educational settings as well as educational values and beliefs, which needed to be reflected in the research design.

4.2 Research design

Burns (2000, p.145) defines a research design as “essentially a plan or strategy aimed at enabling answers to be obtained to research questions”. The research design needs to be clearly defined in order to explore the theoretical issues related to the research questions of the study (Gall, Borg and Gall, 1996; Burns, 2000). Another purpose of framing the research questions is so that the results can be interpreted meaningfully (Gall *et al.*, 1996; Anderson, 1998).

To meet the demands of adequate data collection this study combines qualitative and quantitative methods. First, the arguments from the literature review were incorporated into the design of the instruments. The investigation was designed to

produce a variety of opinions from which to make tentative conclusions (Gall *et al.*, 1996; Anderson, 1998; Wellington, 2000). Data were collected by questionnaire survey and in-depth interviews, which led to the testing of the Study Model (in the form of guided pictures in the questionnaire). Other approaches were used to determine a degree of accuracy of the data through statistical measurements. The quantity surveyor and structural engineer tested the Study Model. Demographic data of participants involved in three government funded primary schools in Kuala Lumpur, Malaysia were also recorded.

In qualitative and quantitative data gathering, the strength of the analysis depends on elements such as

... quality data, based on 'rigorous' style and methodology, analysed with consideration on matters such as validity and reliability. Quality research also depends on the researcher's abilities, including training, experience, past works, status and self-presentation (Patton (1990, p.108).

In order to collect and analyse quality data, this study, as noted, combines qualitative and quantitative methods, and the resulting research design is shown in Figure 4.0. The research design was also devised to demonstrate the activities involved in each phase, since the research commenced in April 2001. A literature review was undertaken to establish the background to the study. The questionnaire and in-depth interview involved designing a questionnaire and interview guide and selection of the research sample. Ethics approval for the questionnaire and in-depth interview was applied for and received in February 2003.

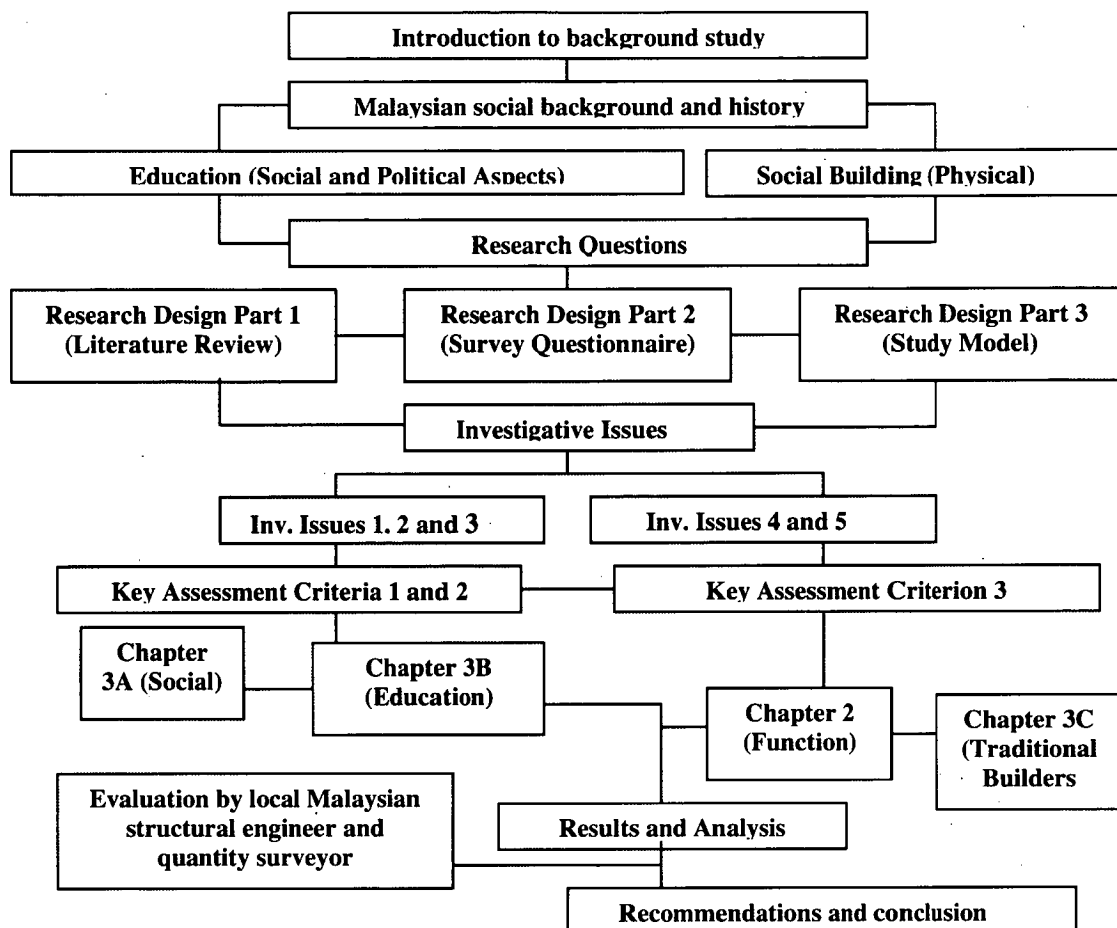


Figure 4.1: Research design

Following this, the principals of three schools were approached to obtain permission to conduct the research. The research initially involved distributing a questionnaire to respondents. In April 2003, data from the questionnaire were coded and entered. These data were used to design the study model by interpreting the opinion of the teaching, learning and playing spaces from the participants to model.

The multi-method approach used in this research forms a research-triangulated strategy described by Burns (2000, p.149) as “the use of two or more methods of data collection in the study of some aspect of human behaviour”. Burns adds that triangulation involves counter-checking the different sources of data using the same approach or a different one, as long as it is for the same study object. The purpose of

triangulation is to fulfil the ethical requirements of confirming reliability and validating findings. In this study triangulation is achieved by making a review of literature; structuring the questionnaire and in-depth interviews to gather further and more specific information; devising 40 study models, based on the questionnaire and interview data; having the 40 study models verified by a local (Malaysian) quantity surveyor and structural engineer; and, finally, proposing a formalised model based, again, on feedback from the quantity surveyor and structural engineer. At all times through the data collection and analysis phases, there was constant reference to the Research Questions, Investigative Issues, and Key Assessment Criteria.

This study was conducted using a multiple-site approach to the research process, to enhance analytical generalisations through replication and thereby produce consistent results (Gall *et al.*, 1996; Burns, 2000). The approach was selected as suitable for the research, to ensure that the data were linked with other factors such as context, roles and activities (professionalism) in government funded primary schools in Malaysia.

The investigation of teaching and learning spaces in government-funded primary schools in Malaysia was conducted in three schools in Kuala Lumpur with different settings (urban, suburban and rural), representative of the range of actual settings in which Malaysian primary schools are located. Data were collected from educational administrators who were responsible for policy-making in all primary schools; teachers who were involved directly with teaching in the existing spaces, and a team of building professionals who were involved in designing and building the spaces. This team comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer.

Data collected from the participants are based on participants' general experiences about only one schooling system. To provide a wider perspective, three schools in Kuala Lumpur were selected, as the research site variations were logical and advantageous for the purpose of comparison. The three schools were chosen as they operate in the same educational system and are organised by the same bureaucracy with the same funding source, the government of Malaysia (Ramli, 2003).

When the theoretical requirements for sample selection were addressed, the selection choice was considered pragmatically (Descombe, 1999). The sites were selected based on the author's personal background knowledge as a child attending a government funded primary school in Kuala Lumpur, working as an assistant architect in City Hall, later as a landscape architect in Putra Jaya Corporation (a new local government authority), and currently as a lecturer in the Department of Landscape Architecture, at the International Islamic University, Malaysia.

The sites were also selected for ease of access to potential participants within the institutions in which the potential participants work. However, it was felt that this could lead to researcher bias, which might affect the research findings. Thus, selecting a research site on the basis of easy access, though relevant, is not the only criterion to justify selection (Denscombe, 1999). Other factors considered in the selection rationale were data collection, time factors and depth.

Assumptions derived from influential factors other than the raw data were obtained from the professional opinion samples. The opinions of established researchers in the field of education and architecture were also sought to validate the research content. To test these suppositions, these data were sought by three research instruments. These were survey questionnaire, in-depth interview and Study Model. All were informed by an extensive literature review.

4.3 Development phases of the research

To assess the educational needs of Malaysian primary schools and the appropriate architectural design responses, the data gathered in this research are presented in two sections:

- Survey research instruments.
- Study Model responses.

A research design (refer to Figure 4.0) was devised to demonstrate the activities involved in each phase.

4.4 Ethics

Ethical requirements were met to ensure no suffering was caused, no one was forced to participate and anonymity was guaranteed to participants. According to Bouma (2000, p.195), 'participants' is the correct term. In this study participants were informed about the purpose of the research study, procedures, risks, discomforts, benefits and their right to withdraw and identify problems. It is important to give participants security, confidentiality and confidence in order for them to provide open and honest communication and maximise the data collecting process. The participants were informed of the conditions of the research and their agreement was obtained before answering the questionnaire. The University of Tasmania gave ethics approval prior to fieldwork being undertaken.

In order to fulfil the requirements of confidentiality and security to participants who were interviewed in this research, they were offered the chance to remain anonymous and informed that all the data collected from the survey would be classified as confidential. The risk to participants were therefore minimised by the research procedure. Their names, personal data (age, qualifications, experience), positions and institution were identified only by code.

4.5 Reliability and validity

This research used several approaches and a variety of sources of evidence for data collection and analysis. As discussed, triangulation of results was possible because of different points of view, including those of the education administrator, teachers and a team of building professionals. The latter comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. Field notes were taken in addition to the transcription of the interview. The research method adopted various techniques of analysis such as descriptive statistics, mean values and correlation analysis for quantitative data and coding and organising the data thematically for qualitative analysis.

Documents were also sought to establish reliability and validity, such as the current primary school curriculum and Post Occupancy Evaluation (POE) (as described in

Chapters 2 and 3). Additional confirmation was gained from individual interviews in three separate sessions with an academic administrator, teachers and a team of building professionals. These interviews were designed for participants to voice their opinions and perspectives, to extend the limited boundaries of the earlier questionnaire format. Thus, the data from the interview were enriched. Interviews led to a better understanding of the study context and support for the quantitative data.

Qualitative or quantitative methods can be used singularly in any research but they can be stronger if both research approaches as both methods produce highly regarded data (Miles and Huberman, 1994; Gall *et al.*, 1996; Anderson, 1998; Denscombe, 1999; Burns, 2000). However, any data analysis approach is limited. In a dual method and multi-method, the researcher has the opportunity to improve research methods with complementary evidence. This produces a stronger analysis, compared with a single method. Triangulation and multi-methods generate richer information.

Being repeatable validates the study and the sample results are made reliable by the triangulation of the data survey, questionnaire and interview. The research approaches, which are both qualitative and quantitative, provide a way to solidify a study via triangulation, as supported by Patton (1990, p.187): “[o]ne important way to strengthen a study design is through triangulation, or the combination of methodologies in the study of the same phenomena”. Further, quantitative measures are

... easily aggregated for analysis; quantitative data are systematic, standardized, and easily presented in a short space. By contrast, the qualitative findings are longer, more detailed, and variable in content (Patton, 1990, p.24).

Therefore a combination of each, overrides their respective problems. Kvale (1995, p.2.) adds that the “present understanding of validity starts in the lived world and daily language, where issues of reliable witness, of valid documents and arguments, are part of the social interaction”. The participants in this study, such as the teachers, educational administrator and the building professionals team are the experts in each categories, and provide the opportunity for testing in the ‘lived world’, rather than the purely academic one. Additionally, the

credibility of the researcher, and therefore the validity of their research can be based on the quality of past research, and that, which receives feedback from qualified peers during the research. The researcher presented a paper at an international conference (refer to Appendix K) in order to receive this feedback, prior to commencing this study.

4.6 Data Collection

The study assesses influences, past and present, on school architecture in government funded primary schools. To do this it incorporates research perspectives from the social sciences, architecture and architecture sciences, landscape architecture and education, as identified in the literature review. The research then uses qualitative and quantitative methods (questionnaire and interviews) combined with findings from the literature review, to provide data on the impact of teaching spaces on teaching, learning and play, in order to suggest improvements in teaching, learning and playing spaces for primary schools in Malaysia.

Based on the literature review, local customs were compared with pedagogical theoretical perspectives and human geography studies on childhood (Holloway and Valentine, 2000), to identify the best way to design teaching, learning and playing spaces, in harmony with local customs and modern needs in the Malaysian multicultural context. To test the suppositions, the views of teachers were sought by means of the following research instruments: the survey questionnaire, in-depth interview and Study Model.

As noted, there were two major research tools used for data collection: a survey questionnaire and an in-depth interview. The survey questionnaire was designed to address the research questions, the literature review and the working study model. This was done for the purpose of creating an appropriate background for the data gathering instruments (Wellington, 2000). The survey questionnaire was divided into three parts, to provide different types of qualitative and quantitative data such as personal background and demographic, structured objective opinions and open-ended questions for free flowing opinions.

The views of professional stakeholders involved in primary school development were also sought. These views included evaluations by an urban and regional planner, an architect, a landscape architect, a mechanical engineer and a quantity surveyor. Evaluation from education administrators and teachers are discussed in detail in the data analysis section for separate views from administrators and practitioners.

According to Glaser and Strauss (1967), in gathering theoretical data working hypotheses may be assumed to guide the data inventory, which will later be adjusted where appropriate during the research. To avoid a conflict of viewpoints between non-educators, such as professional builders and educators with no building experience, both groups were surveyed separately in different sections of the questionnaire. Following this a qualitative comparative study was undertaken, comparing the different stakeholders viewpoints on this issue as a contribution to better understanding the issues involved, as described by Patton (1990).

Henwood and Pidgeon (1992) note there is a requirement for the same query sample to be distributed to all professionals, to justify the neutrality of the sources as points of reference in the comparative data analysis. Accordingly, the data gathered from the literature review, research instruments such as the survey questionnaire and in-depth interview and the study model are the sources of the research results.

4.7 Sampling technique.

Generally speaking, a large sample renders respect for the studies and considerable confidence in the external validity of the findings (Robertson, 1993, p.66). For example, a large number of participants (1400) were used by Silbereisen and Noack (1988). Barazza (1996), used (741) children's drawings from eight schools and two countries in her research, (3 in England and 5 in Mexico), to investigate the way children see places in terms of images. She sampled drawings from English and Mexican school children (7 to 9 years old, in Year 3 of primary education). Thus, considerable variation occurs in sample size across different studies.

According to Bouma (2000, p.131), while large samples may be seen as more conclusive, it is how the sample is drawn that determines how representative it is. In general, large samples are not necessarily better than smaller ones as:

- about thirty individual elements are required in order to provide a pool large enough for even simple kinds of analyses; and
- you need a sample large enough to ensure that it is theoretically possible for each cell in your analytical table to have five cases fall into it.

This research examines a sub-group of a larger population of Malaysian primary school teachers, building professionals and education administrator, using random sampling procedures which “are particularly important in research which aims to access the attitudes, values or beliefs of a population” (N=42) (Bouma, 2000, p.130).

In qualitative studies, according to Marton and Saljo (1976) and Laurillard (1984), the success of the research is dependent on the quality of the information sample, which includes the random sampling strategy for the purpose of establishing reliability and validity of data. Patton (1987) agrees and asserts that the quantity of samples is just a psychological barrier to the researcher. Although a different pattern may be seen when a large sample is used, a small but detailed sample, such as a case study, can provide an elaborate and rich description of a particular issue from a particular prototype design research (Preiser *et al.*, 1998)

According to Bouma (2000, p.137), only randomly drawn samples ensure that the sample is likely to be representative of a larger population. Stratified random sampling is used to compare views of teachers in urban, suburban and rural schools, randomly selected for gender, religious background, length of teaching experience and subjects’ views. Cluster sampling is then used to divide by identifying and enumerating smaller randomly selected segments (clusters) of these samples (Bouma, 2000, p.129). Hence, the sampling procedure used is likely to be representatives of the views of the general population of stakeholders in the areas surveyed. The sample used in this study represents three different school contexts: urban, suburban and rural schools. Details of the questionnaire used in the pilot study measure forty two aspects of current views of the subjects.

4.8 Description of study participants

The perspectives of building professionals were sought to identify their understanding of the importance of thermal comfort to the users of classrooms and the needs of the users in terms of teaching, learning and play, at present and in the future. These professionals comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. The data were collected by questionnaire and subsequent group interview.

Teachers of government funded primary school in Malaysia primary schools were surveyed by questionnaire and interview to obtain their views about the development of schools and children as well as their views on outdoor spaces as teaching, learning and play area at present and in future. The perspective of an education administrator was sought in regard to the quality of teaching spaces at present and plans for upgrading of spaces in the future.

4.9 Survey questionnaire

A close-ended and objective questionnaire was designed to measure the Key Assessment Criteria of the study. The principals of all three schools granted permission for this, and they selected the most appropriate teachers, based on their personal perceptions of their experience and credibility. The questionnaire was designed to obtain both facts and opinions from the participants and to measure both dependent and independent variables. Participants were provided with:

- An information sheet (refer to Appendix H);
- A statement of informed consent to be signed by the participants and the principal of the school (teachers only) and professionals stakeholders. These statements were collected in person (refer to Appendix H); and
- A five-page questionnaire designed for the teachers (refer to Appendix H).

The questionnaire was structured as follows:

PART I

Section A: Background information (three objective and three open-ended questions).

- Section B: Spaces and users at present (two objective questions).
- Section C: Spaces and preferences for teaching and learning (one objective question).
- Section D: Preferences for teaching spaces (eight objective questions with guided pictures of teaching, learning and playing spaces in primary schools, as described in Chapters 2 and 3).
- Section E: Two open-ended questions based on teachers' view about present and future spaces for teaching and learning.

Other professional stakeholders, comprising an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer and an education administrator were provided with a four-page questionnaire (PART II).

PART II

- Section A: Background information (three objective and three open-ended questions).
- Section B: Preferences for teaching spaces (eight objective questions with guided pictures as described previously).
- Section C: Two open-ended questions based on professionals views from an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer and an education administrator with regard to the requirements for present and future teaching and learning spaces.

4.9.1 Administrating the survey questionnaire

The researcher requested of the principal that he or she seek voluntary participants having teaching experience in a wide range of subjects. Thirty six teachers and six building professional were identified as potential as participants were. A cover letter by the researcher outlined the purpose and significance of the study, guaranteed anonymity and invited participants to complete the questionnaire. Respondents were informed that their responses would be confidential and that participants would be identified in the results. Of the thirty six questionnaires distributed (twelve each school), thirty-two were returned (83.3% return rate). All six questionnaires distributed to the education administrator, urban and regional planner, architect,

landscape architect, quantity surveyor and mechanical engineer were returned, giving a 100% return rate.

4.9.2 Limitations of the survey questionnaire approach

The questionnaire contained the appropriate construction and advantages of a questionnaire as stated by Isaac and Michael (1995); Burns (2000). Upon completing the questionnaire, there was a thirty minutes focus group interview as described above.

4.10 In-depth interview

In-depth interviews (with a semi-structured format) were employed to enrich the detailed data gathered from participants (teachers) directly involved in schools. The in-depth interviews were in the form of face-to-face conversations. Open-ended questions were used to promote the flow of conversation, helping to create a more systematic and comprehensive interview (Cohen *et al.*, 2000).

In a semi-structured format, open-ended questions focussed on the participants' perceptions, their surroundings and past-experiences. Standard questions were used to guide them and consequently minimal control was exerted and participants had the freedom to express themselves, thus providing useful qualitative data as outcome of the social interaction between researcher and participants (Burns, 1997, p.331).

This method was applicable as it allowed the researcher "... to acquire the subjective experiences of an individual such as their history, activities, economical scenario, feelings, belief and reality" (Burns, 1997, p.473). The questionnaire, open-ended questions and interviews are used to validate data quality and quantity by producing it to suit the study model, as visual evidence in guided pictures to test the prediction pragmatism comparisons with the model. Two types of interview were conducted: focus group interviews of approximately thirty minutes and fifteen minutes individual interviews.

Focus group interviews of approximately thirty minutes were conducted after the completion of the questionnaire. This was in the form of a group discussion with

teachers to find out their understanding of and preferences for teaching, learning and play spaces. The investigator took notes on the discussions for the purpose of comparisons with the questionnaire responses to enrich her understanding of the teachers' spatial preference for teaching and learning. Immediately after collecting the questionnaire survey, all participating teachers gathered together for a focus group interview. For thirty minutes the researcher asked for their opinions, based on their direct experience teaching in the present teaching spaces.

During these sessions, comments from the group extended the information provided by participants in the questionnaire. With the permission of the headmaster and teachers, notes were taken for later use. The interviews began by informing participants of the purpose of the research providing an overview of the topics to be discussed and confirmed that interviews were confidential and anonymous. The group interview took thirty minutes and the conversation was free flowing and open-ended.

It is often better to use several data gathering techniques to provide different perspectives on questions. Focus groups "combines the strengths of in-depth group interviewing and observation in a group context" (Bouma, 2000, p.181). Suggestions from this thesis regarding changes to outdoor teaching and learning spaces were based on the teachers' responses and matters arising during a thirty minute focus group discussion held in each of the three sample schools. Topics discussed included the school grounds' physical analysis of strengths, weaknesses, opportunities and problems in relation to the research questions.

Fifteen minutes individual interviews were conducted with a representative sample of stakeholders from the building professions (urban and regional planner, architect, landscape architect, quantity surveyor, mechanical engineer and education administrator) to explore their views on teaching, learning and play spaces from a professional perspective.

Although interviews probed issues in-depth and in detail, there are some difficulties related to the use of this approach. Burns (2000) asserts that while interviews have a higher response rate than questionnaires (as participants are more willing to become

involved and interact verbally than to think and write responses to questions) they can be quite affected and intimidated by the presence of the interviewer. The validity of the interview process may be impeded by interviewer bias and the inaccuracy of human memory (Descombe, 1999; Cohen *et al.*, 2000). Burns (2000) notes that interviews need a high level of interviewing skills (particularly interpersonal skills).

By their nature, interviews are time consuming (Isaac and Michael (1995. These limitations were realised in this research and few activities were undertaken to limit the effect of losing time. It was essential that before commencing the interviews to probe the information to be gathered, including the historical background of the school to ensure that all relevant issues were covered.

4.11 Study Model

The study also considered the economic advantages that would result by using local building materials together with traditional and local construction techniques involving assessment from professional stakeholders such as a quantity surveyor and a structural engineer.

If proposed in the future for government funded primary schools, it was anticipated that there would be substantial cost savings in comparison with the current use of building materials in government primary schools. Other than the above advantages it was posited that there would also be pedagogical benefits obtained by increased outdoor classroom teaching based on the literature review in Chapters 2 and 3.

Key Assessment Criteria were developed to test the study model and to devise research guidelines for future use by stakeholders and building professionals. The Key Assessment Criteria are discussed in detail in the following section.

4.11.1 Key Assessment Criteria

Stakeholders and building professionals devised the Key Assessment Criteria for the purpose of testing the study model and generating research guidelines for future use. The Key Assessment Criteria were based on participants' responses and were described in thematic groups. It should be noted that in the discipline of architecture,

the term 'assessment criteria' is an accepted convention while in social sciences it is 'variables'. Since this research is primarily about architecture and landscape architecture the term assessment criteria is adopted. These are described as:

Key Assessment Criterion 1: Architectural influences on Malaysian primary school building. This Key Assessment Criterion is used to examine:

- Architectural form and aesthetic quality of school buildings in the regional/traditional Malay context.
- Indoor and outdoor spatial interaction in comparison with traditional Malay buildings and the landscape.
- Building for the Malaysian school context.

In its desire to be forward-looking, Malaysia needs to synthesise its cultural, social, economic and environmental heritage, in ways that are orientated to the future and to direct education towards better teaching, learning and play spaces at primary school level. To determine the type of architecture most appropriate to educational spaces, relevant studies were examined as a starting point to identifying design trends. Among them, studies by Siddique (1977) and Robertson (1993) are key influences on this study, as are the ideas of educators such as Piaget (1972), Montessori (Lillard, 1972), Steiner (1976) and Vygotsky (1986). The recent work of human geographers such as Holloway and Valentine (2000) and Kong (2000), who have studied the impact of place and space on child development, provide support for the underlying hypothesis on which the study is based.

The issue of costing and design viability were addressed by comparing the adaptability of design and construction of existing Malaysian primary schools with the design of recently constructed primary schools in Northern Australia, which also consider climatic factors (Neufert, 1980; Martin, 2002; Bower, 2003; Aziz and Zaidi, 2003).

A working drawing was obtained of standard school specifications for a typical government primary school in Malaysia (Wan, 2000). These drawings were consulted and costings were compared for the purpose of a costing viability study

(refer to Appendix D). A quantity surveyor and a structural engineer in Malaysia were consulted to verify the costs of the different building materials and construction used. A series of test models were designed to explore the potential of different indoor and outdoor classroom configurations and their construction in the context of Malaysian education, climate and construction methods.

Based on the literature review, local customs were compared with pedagogical theoretical perspectives and human geography studies on childhood (Holloway and Valentine, 2000). This text helped in the identification of the best way to design teaching spaces, in harmony with local customs and the contemporary needs of the Malaysian multi-cultural context and architecture for the primary school.

Key Assessment Criterion 2: Educational qualities of building.

This Key Assessment Criterion is used to examine:

User-friendliness of teaching and learning spaces with particular reference to:

- A sense of belonging, opportunities for free expression and thinking for character development.
- Teaching, learning and play opportunities inherent in spatial design.

In Malaysia, school buildings can be perceived as both a product of a colonial material culture and as a reflection of the Malaysian philosophy on life, which can be broadly described in seemingly contradictory terms as one of unquestioning acceptance of authority and extreme flexibility (Ramli, 2001). However, the literature suggests that the increased use of outdoor classroom teaching and learning is in accordance with original Islamic teaching ideas and methods. Outdoor classroom teaching could help increase environmental awareness in both teachers and pupils and improve thermal comfort and learning outcomes.

Key Assessment Criterion 3: This Key Assessment Criterion is related to performance, cost, structure, materials and ESD. The results are based on the literature review and the opinions of the building professionals surveyed in the questionnaire and interview in relation to:

- climatic performance;
- economic factors;
- building materials and structure;
- future extension options;
- landscape quality; and
- potential user control of environmental condition.

To complement this complex set of Key Assessment Criteria, an equally complex research design was required, including some themes, which have been limited to the theoretical exposition presented in Chapter 3, Part C. All Key Assessment Criteria required different research approaches, including that of practitioners and professionals working in the school system.

4.12 Views of teachers and education officer

The findings of the sample from the fieldwork are used to make recommendations for teaching spaces based on participants' reactions to a photograph used in the questionnaire (refer to Appendix H). The questionnaire was constructed to test the above stakeholders' views about the potential use of outdoor classrooms and their design on a variety of sites. Variable testing across a number of sites is necessary due to competing demands for land use. The high cost of land for non-profit development faced by the government is problematic because of competing demands for urban land by commercial interests.

4.13 Quantity surveyor's and structural engineer's perspectives

Participants were presented with drawings of forty types of structures representing different costs study using different building and construction materials as images for the proposed teaching, learning and playing spaces in primary schools (refer to Appendix H, Questionnaire). The data were based on references such as existing standard drawings of government-funded primary schools (Wan, 2000; Martin, 2002; Aziz and Zaidi, 2003) and other standards for primary schools from *A.J. Metric Handbook* (Fairwater and Sliwa, 1972), *Neufert's Architectural Standard* (1980) and *Australian Commonwealth Standard* (Bower, 2003). Other related professionals such

as the Malaysian structural engineer and quantity surveyor verified the structures drawings and the costings.

4.14 Post Occupancy Evaluation

Post Occupancy Evaluation (POE) research is the process used to investigate and evaluate environments, especially buildings after occupation. This type of investigation looks into how the current occupants use the building (Kirk and Spreckelmeyer, 1988, p.191). In this study the results are intended to be used for future improvement in classroom building design in government funded primary schools in Malaysia, based on responses to the POE questionnaire and interview.

According to Kirk and Spreckelmeyer (1988), the POE can be used, as a basis for comparison to upgrade the current situation according to user needs; to use existing environments for future projects; and to test the present performance about the objectives of the original design.

The guidelines above are appropriate for evaluating education facilities and their design due to the following factors. A budget for school development can be guided by the POE findings. With the increasing number of students and teachers annually in government funded primary schools in Malaysia more schools are required. The change of educational aims parallel developments in teaching and learning pedagogy; this, in turns, requires new approaches to school facilities and spaces. Preiser *et al.* (1988, p.54) claims that the POEs provide benefits over the short, medium and long term.

Short-term benefits include the identification of problems with facilities and the provision of solutions; proactive facility management, responsive to building users values; improved space utilisation and feedback on building performance; occupant perceptions towards the building through an active involvement in the evaluation process; understanding of the performance implications of changes dictated by budget cuts; and informed decision-making and an improve understanding of the consequences of design.

Medium-term benefits include the built-in capacity for facility adaptation to organisational change and growth over time, including recycling of facilities into new uses. There are significant cost savings in the building process and throughout the building's life cycle. Thus, gives accountability for building performance by design professionals and owners.

The improvement in building performance through the life of the building is considered a *long-term benefit*. Additional long-term benefits are the improvement of design databases, standards, criteria and guidance literature and the improved measurement of building performance through quantification. These benefits are consistent with the needs of the providers of education facilities as

- Population expansion requires new schools.
- Changes in teaching methodology and goals means changes to the way in which facilities are used.
- The large capital investment in schools dictates refurbishments and re-use of facilities.
- It can be used to identify the causes of dissatisfaction with a building (rather than simply the perceived causes) and identify ways to correct the problem that may not be immediately apparent to the users of the facility.
- Recording information, along with positive feedback from users for use in future architectural work of a similar nature.

Thus POEs can assist with identifying necessary physical or space utilisation changes. Kirk and Spreckelmeyer (1988, p.191) explain the reasons for a POE and its processes, while Preiser *et al.* (1988, p.55), categorise three types of technique used in the POE as being: *indicative*, *investigative*, and *diagnostic*. The *indicative* POE offers measurements of building failures and performance success based on users' behavioural patterns and comments after a span of familiarisation, occupation and association with current issues. This type of POE produces a summary evaluation of the success or otherwise of the building and provides a user history.

The *investigative* type of POE consists of more meticulous and reliable analysis, variation of types and more information because of increased time spent using the building, than the *indicative* type of POE (Preiser *et al.*, 1988, p.56). After this

process has occurred, teaching and learning spaces in government funded primary schools in Malaysia might be compared with state of the art primary school design in other tropical climates.

Diagnostic POEs, according to Preiser *et al.* (1988, p.57), “usually give accurate prediction data, which is a result of a detailed investigation involving numerous variable.” The indicative POE method could be used to gather information from the main building users and professionals involved in school building and management in order to design guidelines and recommendations for the design of future government funded primary schools in Malaysia.

Other than the indicative POE, according to Auliciems and Szokolay (1997, p.15), the following methods are available for ascertaining human thermal comfort:

- By questionnaires, administered in the field with simultaneous measurement of conditions in spaces normally occupied by the respondents.
- By measurements of physiological changes, such as sweating, skin wetness or skin temperature, which would normally be carried out in laboratories (controlled environment rooms or ‘climate chambers’) (p.15).

The purpose of the sample was to find out the professionals stakeholders’ responses to the research questions. Usually, for a building in use, a team of building professionals, headed by an architect will inspect the building to determine its performance according to the occupant’s views of the building’s defects, if any. This POE information is for future reference (Preiser *et al.*, 1998). In order to obtain financial feedback on the possible cost savings, a proposed model of a school using different local building materials is developed. Based on the model, costing evaluations in line with the current local practice are established according to a quantity surveyor’s estimates.

The results identify the estimated savings in building costs and suggestions for improved landscaping for the purposed of outdoor teaching and learning. Further evaluations are also incorporated, in order to support the research questions. These

evaluations originate from the responses by other related professionals such as the quantity surveyor and the structural engineer.

4.15 Data Classification

Data were entered into an Excel spreadsheet program and then imported into SPSS statistical software for coding and analysis. Comparisons were made between each stakeholder group, per question. Responses to the open-ended items in the questionnaire were transcribed and coded for meaning using the technique of discourse analysis (Burns, 2000) by giving themes to the categories from the participants' opinions. Follow-up interviews with teachers in individual and focus groups were used to probe the meaning of the questionnaire responses in regard to teachers' current perceptions and or preferred options regarding teaching spaces.

To assess the educational needs of Malaysian primary schools and the appropriate architectural design responses, the data gathered in this research are analysed in two stages: survey research instruments and study model responses.

As previously described, the multi-method approach adopted for the research utilised a questionnaire survey, supported by an in-depth interview. Thus, the research produced two forms of information from the guided questionnaires and open-ended questions and interviews. The results of the questionnaire required both qualitative and quantitative analysis. The process of analysis is described in the following sections.

4.16 Interpretation of data

Comparisons of findings from each stakeholder group were used to identify the degree of consensus in educational decision-making. These outcomes were interpreted in the context of the theoretical and practical solutions offered by the text and document analysis. The degree of comparability found between the stakeholder views was used as the basis for articulating a model for the provision of education

teaching, learning and play spaces. Descriptive data were used for research fieldwork other than data analysis from samples of evaluative description. In a number of cases, questionnaire data were re-classified according to themes emerging from the processes of the interview data analysis.

These criteria were used for assessing data reclassification categories for each item of the questionnaire under themes based upon aspects of the literature reviewed and according to the researcher's individual judgement, based on a conceptual understanding of the findings emerging from the interview data analysis. In relation to each of the research questions, the data from the questionnaire were rearranged again within the categories and themes (refer to Appendices I and J, Tables 5.7 and 5.10).

4.17 Analysis of the interview data

The analytical process was structured in a series of stages. The data were read many times for the purpose of searching for keywords or themes related to the research questions. The words or phrases used were categorised from the most frequent to the least used. The themes that emerged and the inter-relationships between categories were then grouped into the major findings related to the research questions. Other than using the group discussion and a rating scale in many areas of semi-structured interview information, the responses were coded and imputed manually into a spreadsheet format. The findings were grouped into the themes identified as emerging from the processes used in the analysis, as previously described. (refer to Appendix J, Tables 5.7 and 5.10).

4.18 Summary

This study employed both qualitative and quantitative methods. The background for the research design was provided by the literature review. Issues of pedagogy were included in the questionnaire and in-depth interview surveys of stakeholders involved in the education system. The purpose of the 'focus group' interview was to find out their experiences involving with the primary schools spaces. The architectural research involved a costing study and model testing following feedback

from teachers, an education administrator, an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer to questionnaires and interviews. They were used as a research design tool for applying theoretical architectural principles and current pedagogy to field-based data collection.

To obtain information related to the research questions, the research method included a Post Occupancy Evaluation of the occupants' experience as users of three government funded primary schools. This POE was related to the previous history, performance, human behavioural patterns and expectations of three different sites and the history of school buildings in relation to tropical architecture and current educational trends.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

The objective of this chapter is to describe the methodology used in this study. This chapter is discussed in the following sections: **Research Design** (which incorporates methodology); **Ethics, Reliability and Validity**; **Data Collection**; **Data Classification**; and **Data Analysis**. In Chapter 1, it was hypothesised that increased use of outdoor teaching and learning spaces will contribute to improved school environments in the hot and humid tropical climate context of Malaysia. From this hypothesis, two research questions were developed, which are approached in an Islamic constructivist manner. For the purposes of this study, 'outdoor classrooms' are defined as spaces that have a roof, adequate floor and semi-open side panels (Yaman, 2002). The research questions are:

Research question 1: What is the nature of current teaching and learning spaces in government funded primary schools in Malaysia?

Research question 2: How can alternative models of school learning and teaching spaces assist primary school environments in Malaysia?

In order to develop an appropriate and sympathetic research design, Malaysian history was researched "to discern the concepts, plans, methods and reasons which have produced building as it is today" (Dewanto, 1997, p.16). Through an understanding of society, culture, behaviour and beliefs, an awareness of the influences that have produced the present day Malaysian education system and its architecture can be achieved. The cultural-historic tradition of Islamic philosophy and learning are strongly adhered to this research. The research questions and the resulting research design involve a number of areas and disciplines, including historical and cultural issues, education, architectural science, construction and landscape architecture, all of which are related to the Malaysian context. A singular research method was deemed to be inappropriate for the complex nature of the problem. Therefore, the use of more than one research method and relevant data types are used to address the research questions.

In this study questionnaires and group interviews were used to seek the opinion of reliable sources, such as current building users, teachers, building professionals involved in designing schools and education administrators. In order to test the validity of the hypothesis a sampling of opinions from building professionals was obtained. This sample (n=6) comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer, and a Ministry of Education officer. Thirty six schoolteachers (n=36) were also interviewed for current views of needs in education spaces, using a questionnaire and in-depth interviews.

A substantial amount of substantive and methodological data has been gathered in this study, which either broadly or specifically addresses the research questions. Due to this, and the complexity of investigating practical design aspects of educational settings while also considering educational values and beliefs, the two research questions are broken down further into five Investigative Issues. These Issues have allowed a focused, yet inclusive, approach to the wide range of factors which impact on this study. Addressing these Investigative Issues, in response to the research questions, has resulted in the generation of three Key Assessment Criteria. Stakeholders and building professionals required these criteria for the purpose of testing the Study Model and generating research guidelines for future use. This is due to the problem involving practical design aspects of educational settings as well as educational values and beliefs, which needed to be reflected in the research design.

4.2 Research design

Burns (2000, p.145) defines a research design as “essentially a plan or strategy aimed at enabling answers to be obtained to research questions”. The research design needs to be clearly defined in order to explore the theoretical issues related to the research questions of the study (Gall, Borg and Gall, 1996; Burns, 2000). Another purpose of framing the research questions is so that the results can be interpreted meaningfully (Gall *et al.*, 1996; Anderson, 1998).

To meet the demands of adequate data collection this study combines qualitative and quantitative methods. First, the arguments from the literature review were incorporated into the design of the instruments. The investigation was designed to

produce a variety of opinions from which to make tentative conclusions (Gall *et al.*, 1996; Anderson, 1998; Wellington, 2000). Data were collected by questionnaire survey and in-depth interviews, which led to the testing of the Study Model (in the form of guided pictures in the questionnaire). Other approaches were used to determine a degree of accuracy of the data through statistical measurements. The quantity surveyor and structural engineer tested the Study Model. Demographic data of participants involved in three government funded primary schools in Kuala Lumpur, Malaysia were also recorded.

In qualitative and quantitative data gathering, the strength of the analysis depends on elements such as

... quality data, based on 'rigorous' style and methodology, analysed with consideration on matters such as validity and reliability. Quality research also depends on the researcher's abilities, including training, experience, past works, status and self-presentation (Patton (1990, p.108).

In order to collect and analyse quality data, this study, as noted, combines qualitative and quantitative methods, and the resulting research design is shown in Figure 4.0. The research design was also devised to demonstrate the activities involved in each phase, since the research commenced in April 2001. A literature review was undertaken to establish the background to the study. The questionnaire and in-depth interview involved designing a questionnaire and interview guide and selection of the research sample. Ethics approval for the questionnaire and in-depth interview was applied for and received in February 2003.

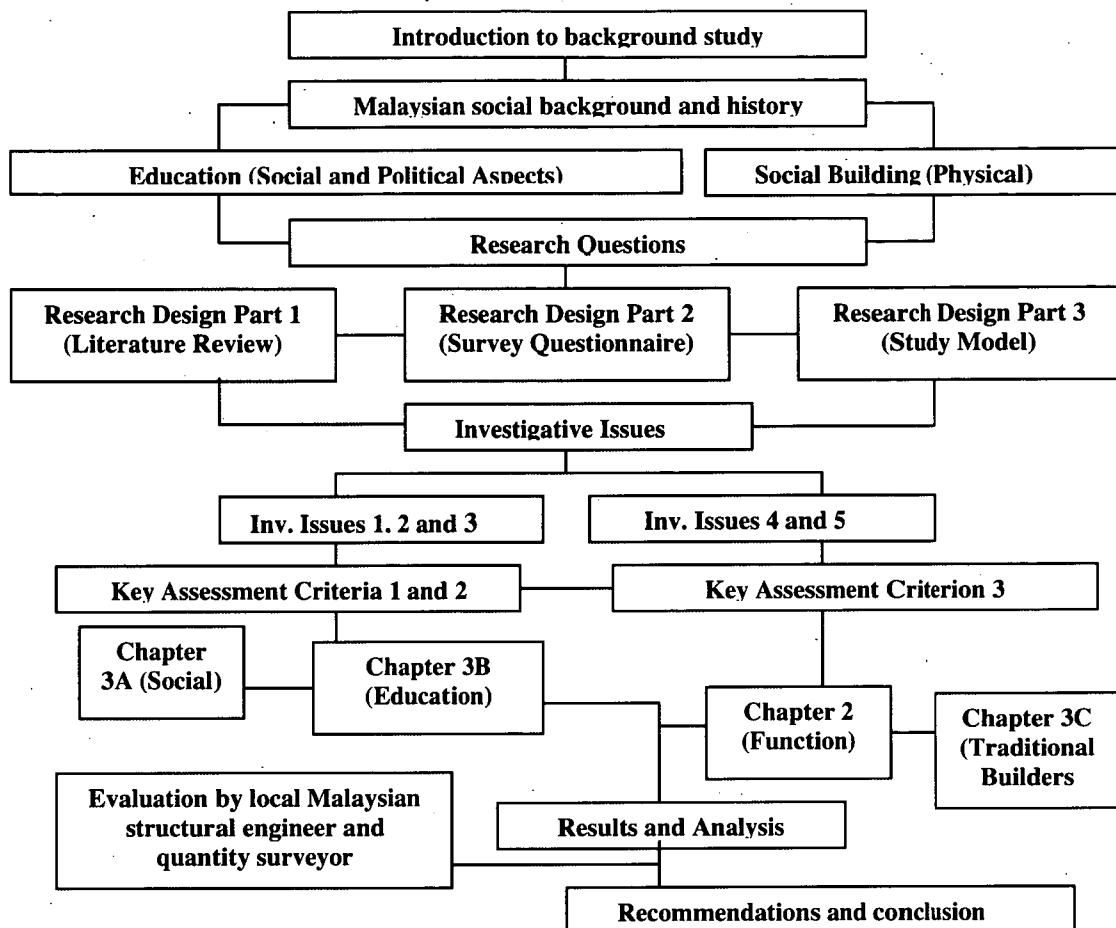


Figure 4.1: Research design

Following this, the principals of three schools were approached to obtain permission to conduct the research. The research initially involved distributing a questionnaire to respondents. In April 2003, data from the questionnaire were coded and entered. These data were used to design the study model by interpreting the opinion of the teaching, learning and playing spaces from the participants to model.

The multi-method approach used in this research forms a research-triangulated strategy described by Burns (2000, p.149) as “the use of two or more methods of data collection in the study of some aspect of human behaviour”. Burns adds that triangulation involves counter-checking the different sources of data using the same approach or a different one, as long as it is for the same study object. The purpose of

triangulation is to fulfil the ethical requirements of confirming reliability and validating findings. In this study triangulation is achieved by making a review of literature; structuring the questionnaire and in-depth interviews to gather further and more specific information; devising 40 study models, based on the questionnaire and interview data; having the 40 study models verified by a local (Malaysian) quantity surveyor and structural engineer; and, finally, proposing a formalised model based, again, on feedback from the quantity surveyor and structural engineer. At all times through the data collection and analysis phases, there was constant reference to the Research Questions, Investigative Issues, and Key Assessment Criteria.

This study was conducted using a multiple-site approach to the research process, to enhance analytical generalisations through replication and thereby produce consistent results (Gall *et al.*, 1996; Burns, 2000). The approach was selected as suitable for the research, to ensure that the data were linked with other factors such as context, roles and activities (professionalism) in government funded primary schools in Malaysia.

The investigation of teaching and learning spaces in government-funded primary schools in Malaysia was conducted in three schools in Kuala Lumpur with different settings (urban, suburban and rural), representative of the range of actual settings in which Malaysian primary schools are located. Data were collected from educational administrators who were responsible for policy-making in all primary schools; teachers who were involved directly with teaching in the existing spaces, and a team of building professionals who were involved in designing and building the spaces. This team comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer.

Data collected from the participants are based on participants' general experiences about only one schooling system. To provide a wider perspective, three schools in Kuala Lumpur were selected, as the research site variations were logical and advantageous for the purpose of comparison. The three schools were chosen as they operate in the same educational system and are organised by the same bureaucracy with the same funding source, the government of Malaysia (Ramli, 2003).

When the theoretical requirements for sample selection were addressed, the selection choice was considered pragmatically (Descombe, 1999). The sites were selected based on the author's personal background knowledge as a child attending a government funded primary school in Kuala Lumpur, working as an assistant architect in City Hall, later as a landscape architect in Putra Jaya Corporation (a new local government authority), and currently as a lecturer in the Department of Landscape Architecture, at the International Islamic University, Malaysia.

The sites were also selected for ease of access to potential participants within the institutions in which the potential participants work. However, it was felt that this could lead to researcher bias, which might affect the research findings. Thus, selecting a research site on the basis of easy access, though relevant, is not the only criterion to justify selection (Denscombe, 1999). Other factors considered in the selection rationale were data collection, time factors and depth.

Assumptions derived from influential factors other than the raw data were obtained from the professional opinion samples. The opinions of established researchers in the field of education and architecture were also sought to validate the research content. To test these suppositions, these data were sought by three research instruments. These were survey questionnaire, in-depth interview and Study Model. All were informed by an extensive literature review.

4.3 Development phases of the research

To assess the educational needs of Malaysian primary schools and the appropriate architectural design responses, the data gathered in this research are presented in two sections:

- Survey research instruments.
- Study Model responses.

A research design (refer to Figure 4.0) was devised to demonstrate the activities involved in each phase.

4.4 Ethics

Ethical requirements were met to ensure no suffering was caused, no one was forced to participate and anonymity was guaranteed to participants. According to Bouma (2000, p.195), 'participants' is the correct term. In this study participants were informed about the purpose of the research study, procedures, risks, discomforts, benefits and their right to withdraw and identify problems. It is important to give participants security, confidentiality and confidence in order for them to provide open and honest communication and maximise the data collecting process. The participants were informed of the conditions of the research and their agreement was obtained before answering the questionnaire. The University of Tasmania gave ethics approval prior to fieldwork being undertaken.

In order to fulfil the requirements of confidentiality and security to participants who were interviewed in this research, they were offered the chance to remain anonymous and informed that all the data collected from the survey would be classified as confidential. The risk to participants were therefore minimised by the research procedure. Their names, personal data (age, qualifications, experience), positions and institution were identified only by code.

4.5 Reliability and validity

This research used several approaches and a variety of sources of evidence for data collection and analysis. As discussed, triangulation of results was possible because of different points of view, including those of the education administrator, teachers and a team of building professionals. The latter comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. Field notes were taken in addition to the transcription of the interview. The research method adopted various techniques of analysis such as descriptive statistics, mean values and correlation analysis for quantitative data and coding and organising the data thematically for qualitative analysis.

Documents were also sought to establish reliability and validity, such as the current primary school curriculum and Post Occupancy Evaluation (POE) (as described in

Chapters 2 and 3). Additional confirmation was gained from individual interviews in three separate sessions with an academic administrator, teachers and a team of building professionals. These interviews were designed for participants to voice their opinions and perspectives, to extend the limited boundaries of the earlier questionnaire format. Thus, the data from the interview were enriched. Interviews led to a better understanding of the study context and support for the quantitative data.

Qualitative or quantitative methods can be used singularly in any research but they can be stronger if both research approaches as both methods produce highly regarded data (Miles and Huberman, 1994; Gall *et al.*, 1996; Anderson, 1998; Denscombe, 1999; Burns, 2000). However, any data analysis approach is limited. In a dual method and multi-method, the researcher has the opportunity to improve research methods with complementary evidence. This produces a stronger analysis, compared with a single method. Triangulation and multi-methods generate richer information.

Being repeatable validates the study and the sample results are made reliable by the triangulation of the data survey, questionnaire and interview. The research approaches, which are both qualitative and quantitative, provide a way to solidify a study via triangulation, as supported by Patton (1990, p.187): “[o]ne important way to strengthen a study design is through triangulation, or the combination of methodologies in the study of the same phenomena”. Further, quantitative measures are

... easily aggregated for analysis; quantitative data are systematic, standardized, and easily presented in a short space. By contrast, the qualitative findings are longer, more detailed, and variable in content (Patton, 1990, p.24).

Therefore a combination of each, overrides their respective problems. Kvale (1995, p.2.) adds that the “present understanding of validity starts in the lived world and daily language, where issues of reliable witness, of valid documents and arguments, are part of the social interaction”. The participants in this study, such as the teachers, educational administrator and the building professionals team are the experts in each categories, and provide the opportunity for testing in the ‘lived world’, rather than the purely academic one. Additionally, the

credibility of the researcher, and therefore the validity of their research can be based on the quality of past research, and that, which receives feedback from qualified peers during the research. The researcher presented a paper at an international conference (refer to Appendix K) in order to receive this feedback, prior to commencing this study.

4.6 Data Collection

The study assesses influences, past and present, on school architecture in government funded primary schools. To do this it incorporates research perspectives from the social sciences, architecture and architecture sciences, landscape architecture and education, as identified in the literature review. The research then uses qualitative and quantitative methods (questionnaire and interviews) combined with findings from the literature review, to provide data on the impact of teaching spaces on teaching, learning and play, in order to suggest improvements in teaching, learning and playing spaces for primary schools in Malaysia.

Based on the literature review, local customs were compared with pedagogical theoretical perspectives and human geography studies on childhood (Holloway and Valentine, 2000), to identify the best way to design teaching, learning and playing spaces, in harmony with local customs and modern needs in the Malaysian multicultural context. To test the suppositions, the views of teachers were sought by means of the following research instruments: the survey questionnaire, in-depth interview and Study Model.

As noted, there were two major research tools used for data collection: a survey questionnaire and an in-depth interview. The survey questionnaire was designed to address the research questions, the literature review and the working study model. This was done for the purpose of creating an appropriate background for the data gathering instruments (Wellington, 2000). The survey questionnaire was divided into three parts, to provide different types of qualitative and quantitative data such as personal background and demographic, structured objective opinions and open-ended questions for free flowing opinions.

The views of professional stakeholders involved in primary school development were also sought. These views included evaluations by an urban and regional planner, an architect, a landscape architect, a mechanical engineer and a quantity surveyor. Evaluation from education administrators and teachers are discussed in detail in the data analysis section for separate views from administrators and practitioners.

According to Glaser and Strauss (1967), in gathering theoretical data working hypotheses may be assumed to guide the data inventory, which will later be adjusted where appropriate during the research. To avoid a conflict of viewpoints between non-educators, such as professional builders and educators with no building experience, both groups were surveyed separately in different sections of the questionnaire. Following this a qualitative comparative study was undertaken, comparing the different stakeholders viewpoints on this issue as a contribution to better understanding the issues involved, as described by Patton (1990).

Henwood and Pidgeon (1992) note there is a requirement for the same query sample to be distributed to all professionals, to justify the neutrality of the sources as points of reference in the comparative data analysis. Accordingly, the data gathered from the literature review, research instruments such as the survey questionnaire and in-depth interview and the study model are the sources of the research results.

4.7 Sampling technique

Generally speaking, a large sample renders respect for the studies and considerable confidence in the external validity of the findings (Robertson, 1993, p.66). For example, a large number of participants (1400) were used by Silbereisen and Noack (1988). Barazza (1996), used (741) children's drawings from eight schools and two countries in her research, (3 in England and 5 in Mexico), to investigate the way children see places in terms of images. She sampled drawings from English and Mexican school children (7 to 9 years old, in Year 3 of primary education). Thus, considerable variation occurs in sample size across different studies.

According to Bouma (2000, p.131), while large samples may be seen as more conclusive, it is how the sample is drawn that determines how representative it is. In general, large samples are not necessarily better than smaller ones as:

- about thirty individual elements are required in order to provide a pool large enough for even simple kinds of analyses; and
- you need a sample large enough to ensure that it is theoretically possible for each cell in your analytical table to have five cases fall into it.

This research examines a sub-group of a larger population of Malaysian primary school teachers, building professionals and education administrator, using random sampling procedures which “are particularly important in research which aims to access the attitudes, values or beliefs of a population” (N=42) (Bouma, 2000, p.130).

In qualitative studies, according to Marton and Saljo (1976) and Laurillard (1984), the success of the research is dependent on the quality of the information sample, which includes the random sampling strategy for the purpose of establishing reliability and validity of data. Patton (1987) agrees and asserts that the quantity of samples is just a psychological barrier to the researcher. Although a different pattern may be seen when a large sample is used, a small but detailed sample, such as a case study, can provide an elaborate and rich description of a particular issue from a particular prototype design research (Preiser *et al.*, 1998)

According to Bouma (2000, p.137), only randomly drawn samples ensure that the sample is likely to be representative of a larger population. Stratified random sampling is used to compare views of teachers in urban, suburban and rural schools, randomly selected for gender, religious background, length of teaching experience and subjects’ views. Cluster sampling is then used to divide by identifying and enumerating smaller randomly selected segments (clusters) of these samples (Bouma, 2000, p.129). Hence, the sampling procedure used is likely to be representatives of the views of the general population of stakeholders in the areas surveyed. The sample used in this study represents three different school contexts: urban, suburban and rural schools. Details of the questionnaire used in the pilot study measure forty two aspects of current views of the subjects.

4.8 Description of study participants

The perspectives of building professionals were sought to identify their understanding of the importance of thermal comfort to the users of classrooms and the needs of the users in terms of teaching, learning and play, at present and in the future. These professionals comprised an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. The data were collected by questionnaire and subsequent group interview.

Teachers of government funded primary school in Malaysia primary schools were surveyed by questionnaire and interview to obtain their views about the development of schools and children as well as their views on outdoor spaces as teaching, learning and play area at present and in future. The perspective of an education administrator was sought in regard to the quality of teaching spaces at present and plans for upgrading of spaces in the future.

4.9 Survey questionnaire

A close-ended and objective questionnaire was designed to measure the Key Assessment Criteria of the study. The principals of all three schools granted permission for this, and they selected the most appropriate teachers, based on their personal perceptions of their experience and credibility. The questionnaire was designed to obtain both facts and opinions from the participants and to measure both dependent and independent variables. Participants were provided with:

- An information sheet (refer to Appendix H);
- A statement of informed consent to be signed by the participants and the principal of the school (teachers only) and professionals stakeholders. These statements were collected in person (refer to Appendix H); and
- A five-page questionnaire designed for the teachers (refer to Appendix H).

The questionnaire was structured as follows:

PART I

Section A: Background information (three objective and three open-ended questions).

- Section B: Spaces and users at present (two objective questions).
- Section C: Spaces and preferences for teaching and learning (one objective question).
- Section D: Preferences for teaching spaces (eight objective questions with guided pictures of teaching, learning and playing spaces in primary schools, as described in Chapters 2 and 3).
- Section E: Two open-ended questions based on teachers' view about present and future spaces for teaching and learning.

Other professional stakeholders, comprising an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer and an education administrator were provided with a four-page questionnaire (PART II).

PART II

- Section A: Background information (three objective and three open-ended questions).
- Section B: Preferences for teaching spaces (eight objective questions with guided pictures as described previously).
- Section C: Two open-ended questions based on professionals views from an urban and regional planner, an architect, a landscape architect, a quantity surveyor, a mechanical engineer and an education administrator with regard to the requirements for present and future teaching and learning spaces.

4.9.1 Administrating the survey questionnaire

The researcher requested of the principal that he or she seek voluntary participants having teaching experience in a wide range of subjects. Thirty six teachers and six building professional were identified as potential as participants were. A cover letter by the researcher outlined the purpose and significance of the study, guaranteed anonymity and invited participants to complete the questionnaire. Respondents were informed that their responses would be confidential and that participants would be identified in the results. Of the thirty six questionnaires distributed (twelve each school), thirty-two were returned (83.3% return rate). All six questionnaires distributed to the education administrator, urban and regional planner, architect,

landscape architect, quantity surveyor and mechanical engineer were returned, giving a 100% return rate.

4.9.2 Limitations of the survey questionnaire approach

The questionnaire contained the appropriate construction and advantages of a questionnaire as stated by Isaac and Michael (1995); Burns (2000). Upon completing the questionnaire, there was a thirty minutes focus group interview as described above.

4.10 In-depth interview

In-depth interviews (with a semi-structured format) were employed to enrich the detailed data gathered from participants (teachers) directly involved in schools. The in-depth interviews were in the form of face-to-face conversations. Open-ended questions were used to promote the flow of conversation, helping to create a more systematic and comprehensive interview (Cohen *et al.*, 2000).

In a semi-structured format, open-ended questions focussed on the participants' perceptions, their surroundings and past-experiences. Standard questions were used to guide them and consequently minimal control was exerted and participants had the freedom to express themselves, thus providing useful qualitative data as outcome of the social interaction between researcher and participants (Burns, 1997, p.331).

This method was applicable as it allowed the researcher "... to acquire the subjective experiences of an individual such as their history, activities, economical scenario, feelings, belief and reality" (Burns, 1997, p.473). The questionnaire, open-ended questions and interviews are used to validate data quality and quantity by producing it to suit the study model, as visual evidence in guided pictures to test the prediction pragmatism comparisons with the model. Two types of interview were conducted: focus group interviews of approximately thirty minutes and fifteen minutes individual interviews.

Focus group interviews of approximately thirty minutes were conducted after the completion of the questionnaire. This was in the form of a group discussion with

teachers to find out their understanding of and preferences for teaching, learning and play spaces. The investigator took notes on the discussions for the purpose of comparisons with the questionnaire responses to enrich her understanding of the teachers' spatial preference for teaching and learning. Immediately after collecting the questionnaire survey, all participating teachers gathered together for a focus group interview. For thirty minutes the researcher asked for their opinions, based on their direct experience teaching in the present teaching spaces.

During these sessions, comments from the group extended the information provided by participants in the questionnaire. With the permission of the headmaster and teachers, notes were taken for later use. The interviews began by informing participants of the purpose of the research providing an overview of the topics to be discussed and confirmed that interviews were confidential and anonymous. The group interview took thirty minutes and the conversation was free flowing and open-ended.

It is often better to use several data gathering techniques to provide different perspectives on questions. Focus groups "combines the strengths of in-depth group interviewing and observation in a group context" (Bouma, 2000, p.181). Suggestions from this thesis regarding changes to outdoor teaching and learning spaces were based on the teachers' responses and matters arising during a thirty minute focus group discussion held in each of the three sample schools. Topics discussed included the school grounds' physical analysis of strengths, weaknesses, opportunities and problems in relation to the research questions.

Fifteen minutes individual interviews were conducted with a representative sample of stakeholders from the building professions (urban and regional planner, architect, landscape architect, quantity surveyor, mechanical engineer and education administrator) to explore their views on teaching, learning and play spaces from a professional perspective.

Although interviews probed issues in-depth and in detail, there are some difficulties related to the use of this approach. Burns (2000) asserts that while interviews have a higher response rate than questionnaires (as participants are more willing to become

involved and interact verbally than to think and write responses to questions) they can be quite affected and intimidated by the presence of the interviewer. The validity of the interview process may be impeded by interviewer bias and the inaccuracy of human memory (Descombe, 1999; Cohen *et al.*, 2000). Burns (2000) notes that interviews need a high level of interviewing skills (particularly interpersonal skills).

By their nature, interviews are time consuming (Isaac and Michael (1995. These limitations were realised in this research and few activities were undertaken to limit the effect of losing time. It was essential that before commencing the interviews to probe the information to be gathered, including the historical background of the school to ensure that all relevant issues were covered.

4.11 Study Model

The study also considered the economic advantages that would result by using local building materials together with traditional and local construction techniques involving assessment from professional stakeholders such as a quantity surveyor and a structural engineer.

If proposed in the future for government funded primary schools, it was anticipated that there would be substantial cost savings in comparison with the current use of building materials in government primary schools. Other than the above advantages it was posited that there would also be pedagogical benefits obtained by increased outdoor classroom teaching based on the literature review in Chapters 2 and 3.

Key Assessment Criteria were developed to test the study model and to devise research guidelines for future use by stakeholders and building professionals. The Key Assessment Criteria are discussed in detail in the following section.

4.11.1 Key Assessment Criteria

Stakeholders and building professionals devised the Key Assessment Criteria for the purpose of testing the study model and generating research guidelines for future use. The Key Assessment Criteria were based on participants' responses and were described in thematic groups. It should be noted that in the discipline of architecture,

the term 'assessment criteria' is an accepted convention while in social sciences it is 'variables'. Since this research is primarily about architecture and landscape architecture the term assessment criteria is adopted. These are described as:

Key Assessment Criterion 1: Architectural influences on Malaysian primary school building. This Key Assessment Criterion is used to examine:

- Architectural form and aesthetic quality of school buildings in the regional/traditional Malay context.
- Indoor and outdoor spatial interaction in comparison with traditional Malay buildings and the landscape.
- Building for the Malaysian school context.

In its desire to be forward-looking, Malaysia needs to synthesise its cultural, social, economic and environmental heritage, in ways that are orientated to the future and to direct education towards better teaching, learning and play spaces at primary school level. To determine the type of architecture most appropriate to educational spaces, relevant studies were examined as a starting point to identifying design trends. Among them, studies by Siddique (1977) and Robertson (1993) are key influences on this study, as are the ideas of educators such as Piaget (1972), Montessori (Lillard, 1972), Steiner (1976) and Vygotsky (1986). The recent work of human geographers such as Holloway and Valentine (2000) and Kong (2000), who have studied the impact of place and space on child development, provide support for the underlying hypothesis on which the study is based.

The issue of costing and design viability were addressed by comparing the adaptability of design and construction of existing Malaysian primary schools with the design of recently constructed primary schools in Northern Australia, which also consider climatic factors (Neufert, 1980; Martin, 2002; Bower, 2003; Aziz and Zaidi, 2003).

A working drawing was obtained of standard school specifications for a typical government primary school in Malaysia (Wan, 2000). These drawings were consulted and costings were compared for the purpose of a costing viability study

(refer to Appendix D). A quantity surveyor and a structural engineer in Malaysia were consulted to verify the costs of the different building materials and construction used. A series of test models were designed to explore the potential of different indoor and outdoor classroom configurations and their construction in the context of Malaysian education, climate and construction methods.

Based on the literature review, local customs were compared with pedagogical theoretical perspectives and human geography studies on childhood (Holloway and Valentine, 2000). This text helped in the identification of the best way to design teaching spaces, in harmony with local customs and the contemporary needs of the Malaysian multi-cultural context and architecture for the primary school.

Key Assessment Criterion 2: Educational qualities of building.

This Key Assessment Criterion is used to examine:

User-friendliness of teaching and learning spaces with particular reference to:

- A sense of belonging, opportunities for free expression and thinking for character development.
- Teaching, learning and play opportunities inherent in spatial design.

In Malaysia, school buildings can be perceived as both a product of a colonial material culture and as a reflection of the Malaysian philosophy on life, which can be broadly described in seemingly contradictory terms as one of unquestioning acceptance of authority and extreme flexibility (Ramli, 2001). However, the literature suggests that the increased use of outdoor classroom teaching and learning is in accordance with original Islamic teaching ideas and methods. Outdoor classroom teaching could help increase environmental awareness in both teachers and pupils and improve thermal comfort and learning outcomes.

Key Assessment Criterion 3: This Key Assessment Criterion is related to performance, cost, structure, materials and ESD. The results are based on the literature review and the opinions of the building professionals surveyed in the questionnaire and interview in relation to:

- climatic performance;
- economic factors;
- building materials and structure;
- future extension options;
- landscape quality; and
- potential user control of environmental condition.

To complement this complex set of Key Assessment Criteria, an equally complex research design was required, including some themes, which have been limited to the theoretical exposition presented in Chapter 3, Part C. All Key Assessment Criteria required different research approaches, including that of practitioners and professionals working in the school system.

4.12 Views of teachers and education officer

The findings of the sample from the fieldwork are used to make recommendations for teaching spaces based on participants' reactions to a photograph used in the questionnaire (refer to Appendix H). The questionnaire was constructed to test the above stakeholders' views about the potential use of outdoor classrooms and their design on a variety of sites. Variable testing across a number of sites is necessary due to competing demands for land use. The high cost of land for non-profit development faced by the government is problematic because of competing demands for urban land by commercial interests.

4.13 Quantity surveyor's and structural engineer's perspectives

Participants were presented with drawings of forty types of structures representing different costs study using different building and construction materials as images for the proposed teaching, learning and playing spaces in primary schools (refer to Appendix H, Questionnaire). The data were based on references such as existing standard drawings of government-funded primary schools (Wan, 2000; Martin, 2002; Aziz and Zaidi, 2003) and other standards for primary schools from *A.J. Metric Handbook* (Fairwater and Sliwa, 1972), *Neufert's Architectural Standard* (1980) and *Australian Commonwealth Standard* (Bower, 2003). Other related professionals such

as the Malaysian structural engineer and quantity surveyor verified the structures drawings and the costings.

4.14 Post Occupancy Evaluation

Post Occupancy Evaluation (POE) research is the process used to investigate and evaluate environments, especially buildings after occupation. This type of investigation looks into how the current occupants use the building (Kirk and Spreckelmeyer, 1988, p.191). In this study the results are intended to be used for future improvement in classroom building design in government funded primary schools in Malaysia, based on responses to the POE questionnaire and interview.

According to Kirk and Spreckelmeyer (1988), the POE can be used, as a basis for comparison to upgrade the current situation according to user needs; to use existing environments for future projects; and to test the present performance about the objectives of the original design.

The guidelines above are appropriate for evaluating education facilities and their design due to the following factors. A budget for school development can be guided by the POE findings. With the increasing number of students and teachers annually in government funded primary schools in Malaysia more schools are required. The change of educational aims parallel developments in teaching and learning pedagogy; this, in turns, requires new approaches to school facilities and spaces. Preiser *et al.* (1988, p.54) claims that the POEs provide benefits over the short, medium and long term.

Short-term benefits include the identification of problems with facilities and the provision of solutions; proactive facility management, responsive to building users values; improved space utilisation and feedback on building performance; occupant perceptions towards the building through an active involvement in the evaluation process; understanding of the performance implications of changes dictated by budget cuts; and informed decision-making and an improve understanding of the consequences of design.

Medium-term benefits include the built-in capacity for facility adaptation to organisational change and growth over time, including recycling of facilities into new uses. There are significant cost savings in the building process and throughout the building's life cycle. Thus, gives accountability for building performance by design professionals and owners.

The improvement in building performance through the life of the building is considered a *long-term benefit*. Additional long-term benefits are the improvement of design databases, standards, criteria and guidance literature and the improved measurement of building performance through quantification. These benefits are consistent with the needs of the providers of education facilities as

- Population expansion requires new schools.
- Changes in teaching methodology and goals means changes to the way in which facilities are used.
- The large capital investment in schools dictates refurbishments and re-use of facilities.
- It can be used to identify the causes of dissatisfaction with a building (rather than simply the perceived causes) and identify ways to correct the problem that may not be immediately apparent to the users of the facility.
- Recording information, along with positive feedback from users for use in future architectural work of a similar nature.

Thus POEs can assist with identifying necessary physical or space utilisation changes. Kirk and Spreckelmeyer (1988, p.191) explain the reasons for a POE and its processes, while Preiser *et al.* (1988, p.55), categorise three types of technique used in the POE as being: *indicative*, *investigative*, and *diagnostic*. The *indicative* POE offers measurements of building failures and performance success based on users' behavioural patterns and comments after a span of familiarisation, occupation and association with current issues. This type of POE produces a summary evaluation of the success or otherwise of the building and provides a user history.

The *investigative* type of POE consists of more meticulous and reliable analysis, variation of types and more information because of increased time spent using the building, than the *indicative* type of POE (Preiser *et al.*, 1988, p.56). After this

process has occurred, teaching and learning spaces in government funded primary schools in Malaysia might be compared with state of the art primary school design in other tropical climates.

Diagnostic POEs, according to Preiser *et al.* (1988, p.57), “usually give accurate prediction data, which is a result of a detailed investigation involving numerous variable.” The indicative POE method could be used to gather information from the main building users and professionals involved in school building and management in order to design guidelines and recommendations for the design of future government funded primary schools in Malaysia.

Other than the indicative POE, according to Auliciems and Szokolay (1997, p.15), the following methods are available for ascertaining human thermal comfort:

- By questionnaires, administered in the field with simultaneous measurement of conditions in spaces normally occupied by the respondents.
 - By measurements of physiological changes, such as sweating, skin wetness or skin temperature, which would normally be carried out in laboratories (controlled environment rooms or ‘climate chambers’)
- (p.15).

The purpose of the sample was to find out the professionals stakeholders’ responses to the research questions. Usually, for a building in use, a team of building professionals, headed by an architect will inspect the building to determine its performance according to the occupant’s views of the building’s defects, if any. This POE information is for future reference (Preiser *et al.*, 1998). In order to obtain financial feedback on the possible cost savings, a proposed model of a school using different local building materials is developed. Based on the model, costing evaluations in line with the current local practice are established according to a quantity surveyor’s estimates.

The results identify the estimated savings in building costs and suggestions for improved landscaping for the purposed of outdoor teaching and learning. Further evaluations are also incorporated, in order to support the research questions. These

evaluations originate from the responses by other related professionals such as the quantity surveyor and the structural engineer.

4.15 Data Classification

Data were entered into an Excel spreadsheet program and then imported into SPSS statistical software for coding and analysis. Comparisons were made between each stakeholder group, per question. Responses to the open-ended items in the questionnaire were transcribed and coded for meaning using the technique of discourse analysis (Burns, 2000) by giving themes to the categories from the participants' opinions. Follow-up interviews with teachers in individual and focus groups were used to probe the meaning of the questionnaire responses in regard to teachers' current perceptions and or preferred options regarding teaching spaces.

To assess the educational needs of Malaysian primary schools and the appropriate architectural design responses, the data gathered in this research are analysed in two stages: survey research instruments and study model responses.

As previously described, the multi-method approach adopted for the research utilised a questionnaire survey, supported by an in-depth interview. Thus, the research produced two forms of information from the guided questionnaires and open-ended questions and interviews. The results of the questionnaire required both qualitative and quantitative analysis. The process of analysis is described in the following sections.

4.16 Interpretation of data

Comparisons of findings from each stakeholder group were used to identify the degree of consensus in educational decision-making. These outcomes were interpreted in the context of the theoretical and practical solutions offered by the text and document analysis. The degree of comparability found between the stakeholder views was used as the basis for articulating a model for the provision of education

teaching, learning and play spaces. Descriptive data were used for research fieldwork other than data analysis from samples of evaluative description. In a number of cases, questionnaire data were re-classified according to themes emerging from the processes of the interview data analysis.

These criteria were used for assessing data reclassification categories for each item of the questionnaire under themes based upon aspects of the literature reviewed and according to the researcher's individual judgement, based on a conceptual understanding of the findings emerging from the interview data analysis. In relation to each of the research questions, the data from the questionnaire were rearranged again within the categories and themes (refer to Appendices I and J, Tables 5.7 and 5.10).

4.17 Analysis of the interview data

The analytical process was structured in a series of stages. The data were read many times for the purpose of searching for keywords or themes related to the research questions. The words or phrases used were categorised from the most frequent to the least used. The themes that emerged and the inter-relationships between categories were then grouped into the major findings related to the research questions. Other than using the group discussion and a rating scale in many areas of semi-structured interview information, the responses were coded and imputed manually into a spreadsheet format. The findings were grouped into the themes identified as emerging from the processes used in the analysis, as previously described. (refer to Appendix J, Tables 5.7 and 5.10).

4.18 Summary

This study employed both qualitative and quantitative methods. The background for the research design was provided by the literature review. Issues of pedagogy were included in the questionnaire and in-depth interview surveys of stakeholders involved in the education system. The purpose of the 'focus group' interview was to find out their experiences involving with the primary schools spaces. The architectural research involved a costing study and model testing following feedback

from teachers, an education administrator, an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer to questionnaires and interviews. They were used as a research design tool for applying theoretical architectural principles and current pedagogy to field-based data collection.

To obtain information related to the research questions, the research method included a Post Occupancy Evaluation of the occupants' experience as users of three government funded primary schools. This POE was related to the previous history, performance, human behavioural patterns and expectations of three different sites and the history of school buildings in relation to tropical architecture and current educational trends.

CHAPTER 5: RESULTS

5.1 Introduction

This chapter summarises the results of the research findings in relation to the research questions described in Chapter 4. The results described in this chapter are derived from the survey questionnaire sampling of government funded primary schools teachers, an education administrator and building professionals. This questionnaire was employed to gauge the desirability of the research hypothesis that there is a need to improve the standard government funded primary schools in the tropical and hot humid climate in Malaysian environment by increased use of outdoor teaching and learning spaces, from the point of view of education and school design professions.

Results include the views of significant stakeholders in three government funded primary schools, comprising one rural primary school, one suburban school and one urban school. A need for improvement to the physical teaching environment was identified from the data collected in the research.

5.1.2 Research questions

The research relates to how to develop a more appropriate primary school model that considers Malaysian climatic conditions and ESD principles. This involved using external landscaping following the principles of existing non-European models (such as the *madrassa*), which offer cost-effective benefits to users (students and teachers) and optimise health, comfort and improved learning outcomes.

The proposed improved physical environment should produce substantial financial savings compared to current standard school building practices and the financial resources thus saved could be used to fund major improvements in the landscaping of school grounds. The improved, high quality school landscapes would both improve the human comfort conditions of the classroom structures and provide the conditions and environment for pupils to experience aesthetically rich and

ecologically positive surroundings. The specific research questions investigated were:

Research question 1: What is the nature of current teaching and learning spaces in government funded primary schools in Malaysia?

Research question 2: How can alternative models of school learning and teaching spaces assist primary school environments in Malaysia?

Each of these questions was considered through a series of Investigative issues. These became the focus of the research investigation to test the hypothesis.

5.1.3 Investigative Issues

Due to the problems involving practical design aspects of educational settings as well as educational values and beliefs, which needed to be reflected in the research design, the research questions are refined into five Investigative Issues.

The Investigative Issues include ways in which Malaysian schools incorporate and use outdoor space. This information is interpreted against a background of the historic origins and influences of the present Malaysian educational system and significant historic examples for outdoor teaching and learning both in Islamic and European educational history. This information is used to develop an external classroom space model for use in the Malaysian education system. A comparison is made of how architectural models incorporate outdoor spaces, with the performance of traditional schools in Malaysia. This leads to the proposal for a new school model based on outdoor teaching and learning spaces applicable to standard Malaysian school sites.

Finally, stakeholder views are sought to ascertain current educational thinking and its relationship to teaching, learning and the natural environment. The data gathered are used to propose a design for improved outdoor classroom spaces, which can be integrated into the physical environment of standard primary school sites in Malaysia.

This research investigated the current needs of users (both primary school pupils and teachers), in relation to education spaces, with a view to upgrading the present education spaces, in order to maximise their educational and human comfort potential. To obtain results for testing the Key Assessment Criteria (refer to Figure 4.0) for the school model there were five Investigative Issues to be considered. They are:

1. The ways in which government funded primary schools incorporate and use outdoor space.
2. How stakeholder views reflect current thinking in education.
3. Issues relating to the development of an external classroom model.

These issues were identified from the data provided by the literature review, detailing:

- The historical influences on Malaysian school education.
 - Significant historical examples of outdoor teaching and learning both in Islamic and European educational history.
 - The extant research into children's cognitive development and human geography.
4. A comparison of the climatic performance of the proposed model with the performance of current government funded primary schools.
 5. The perceived need for improvement of outdoor classrooms spaces.

This chapter includes a discussion of the architectural research design model developed as a research tool in this study. This architectural model was developed to test the validity of the major findings of the research on a hypothetical school model for a real site in Kuala Lumpur.

5.1.4 Testing the hypothesis

For Muslim students growing up in Malaysia there is a continual reminder of the influences of nature on the landscape and indirectly on teaching and learning contexts. As a student of architecture this observation has led to the underlying queries of this thesis. The Prophet has taught Muslim students to be responsible to the natural environment around, but the essentials of his teachings are forgotten in this respect. This is due to more recent pressures from colonial influences and economic rationalism. Therefore this research attempted to determine if there is an

alternative to the current indoor restricted Malaysian primary school environment, which more closely follows Islamic teachings about a responsible exchange between the natural and built environment in the context of a modern society. There is the assumption that this research indicates the economic, environmental and pedagogical benefits of using such a model in the Malaysian context. Thus, the research is based on the hypothesis that the increased use of outdoor classrooms in primary education in Malaysia could provide many benefits to Malaysian society. These include environmental, social and cost benefits, additional space for students, significant learning opportunities and improved thermal comfort in primary school buildings.

The Key Assessment Criteria (outlined in Chapter 4) were used to test the hypothesis that there is a need to improve the standard Malaysian tropical hot and humid school environment by increased use of outdoor teaching and learning spaces. The research results are divided into four broad sections:

- i. The results of the literature review in relation to the historic origins of Malaysian primary school education and architecture, including past and present examples of outdoor teaching and learning (refer to Section 5.2).
- ii. The results of the survey questionnaire, which sampled the opinions of groups of government funded primary schools teachers in relation to outdoor teaching and learning methods (refer to Section 5.3).
- iii. The results of the survey questionnaire administered to selected professionals involved in the design, construction and management of Malaysian government funded primary schools. Response from both groups were used to determine the desirability and feasibility of an alternative school model (refer to Section 5.4).
- iv. The qualitative research results which were used to generate the design of a number of prototypical roofed, but otherwise open, classroom structures and finally a prototype school model, using clusters of these classrooms, comprising a naturally ventilated, enclosed classroom and amenities' space in the centre of each cluster (refer to Part B, Results of the Study Model).

This chapter includes the development of a school design model (based on Sections 1, 2 and 3, as described above) for use as a research tool in this study. This

architectural model of a hypothetical school design at a real site in Kuala Lumpur was developed to test the validity of the major findings of the research.

5.2 Results of the literature review

The review of the historic origins of the present Malaysian school system clearly demonstrates that the curriculum, pedagogy and the physical teaching and learning environments of current Malaysian government funded primary schools from directly developed English colonial school education and architecture. Both the educational methods and aims, together with the architectural resolution of school buildings, were updated from time to time in the past, to remain parallel with then current developments in Britain, particularly after the Second World War.

The introduction of the National Curriculum (after the independence of Malaysia) unified the school curriculum establishing *Bahasa Malaysia* as a standard school language, and added Malaysian context and Islamic studies and religious practices to the school curriculum. However, apart from these additions, the previous European-type teaching and learning content of the colonial schools was retained. The present teaching and learning environment of Malaysian government funded primary schools involves mostly instruction-based teaching in a highly structured classroom environment. It seems that newer educational ideas, which have been developed in the past thirty years in English speaking countries, are yet to find acceptance in the Malaysian government funded primary schools system.

Malaysian school architecture has followed a similar course. The early schools were copies of Victorian English schools with little regard shown to the differences in climate or culture. Newer schools followed the school architecture trends in England at the time of their building but often using cheaper building material and construction methods. Current government funded primary schools remain conservative in design. They are usually utilitarian, two to four storeys high, slab buildings, with rows of regimented single classrooms, opening off roofed verandas on one side of the building. Insulation is usually minimal and the buildings are often roofed with dark coloured concrete tiles. Most government funded primary schools buildings have only electric fans to provide assistance to natural ventilation, with air

conditioning only in selected administrative offices. Typically limited overhangs and concrete and brick walls, together with concrete roof tiles absorb tropical heat readily and radiate it back to the interiors of the buildings in the early afternoon, during school hours. The siting of the buildings is rarely considerate of natural air movement on the site. There is a preference for hard, heat-absorbing and heat-reflecting paving materials on the school sites, to reduce maintenance. While tree plantings and some ornamental planting beds may be provided, there is little evidence of conscious design efforts to use trees as major climatic ameliorative tools to reduce outside temperatures and to shade building walls and roofs.

The literature review of the history of outdoor, open-air teaching and learning shows that open-air teaching was practiced in classical times in Mediterranean Europe. However, this practice diminished with the introduction of monastic-type schools with the onset of Christianity and church-controlled education. In the 20th century, limited outdoor-oriented teaching and learning re-emerged in Europe as a result of new teaching methods in the 1930s, with the innovations of educational pioneers such as Montessori, Steiner and Neill. In the case of educationists and their followers, open-air teaching was connected to some form of physical activity such as gardening, dancing or art and craftwork. Most of the schools, which follow their example, were located in pleasant, natural or naturalistic landscapes. There was also an attempt in the 1930s to introduce outdoor classes in a few schools, mainly due to a perceived need for a healthier environment since English working class school children, for example, had experienced a lack of sunshine and rickets was a serious disease at the time.

Islamic Koranic education also has a strong historic affinity with outdoor teaching. The teaching and learning of the Koran is known to have begun under the shade of trees in the open, and is still practised in this way in some rural communities in Arabia, Africa, and Asia. As Islam advanced, mosques were built with adjoining *madrasa* and indoor, classroom type teaching took over in urban areas. However, the *madrasa* classrooms often retained a direct connection with the outdoors through the adjoining open courtyard, which also served as a teaching space. An interesting modern educational experiment in outdoor teaching in an Islamic country is the Pakistan Education Department's building of a series of rural schools in the 1970s

within enclosed courtyards but with open sided, simply roofed classroom structures adjoining the courtyard walls.

The traditional Islamic *pondok* school has been revived in Malaysia, and particularly in neighbouring Indonesia. There is little available research information regarding the architectural nature and quality of these rural schools but it can be assumed that the historic *pondok* schools used traditional, semi-open Malay rural houses as school rooms. More recently, Abu (1990) has envisaged a *pondok* school complex as a group of traditional type, but purpose-built, Malay buildings on elevated timber platforms with wide, open verandas.

There are emerging trends in the northern (hotter) parts of Australia to build new, partly or fully open, roofed classrooms on elevated timber platforms for indigenous school children. Most Australian primary schools have informal outdoor teaching areas on the grounds and the first purpose built outdoor lecture 'room' has been built at the University of Queensland (Hill and Medek, 1999).

5.3 Results of the primary schools teachers' survey

The survey aimed to ascertain the level of satisfaction with the present teaching environment and to gain insight into the attitudes of Malaysian government funded primary schools teachers towards teaching in a sheltered, but open space. The survey is not intended to be an authoritative, statistically justified survey. It was carried out to ascertain teachers' subjective views about the need for change in the teaching environment. The three schools chosen for the survey represent typical government funded primary schools in Malaysia (as discussed in Chapter 2).

In **Part A** of this chapter results are reported from the responses to the questionnaire survey to indicate:

- The demographic characteristics of the sample.
- Teachers' perceptions of comfort zones for teaching and preferences for classroom locations.
- Professional practitioners' perceptions of comfort zones for teaching and preferences for classroom locations.

Results are also reported from:

- The Preliminary Site Survey Analysis.
- The Survey of Post Occupancy Evaluation in Primary Schools.

The research results (reported in Part A) provide data in response to the research questions and the Key Assessment Criteria. Accordingly, teachers' and professional practitioners' views were sought to provide:

- Stakeholders' views of the current Malaysian government funded primary schools physical environment.
- An understanding of attitudes and perceptions in regard to teaching, learning, playing and classroom design of selected and representative groups of government funded primary schools teachers and professionals in Malaysia who are involved with school design and management.

In **Part B** the architectural responses to the model are reported, based on building professionals' views about the research design model for a hypothetical site. The model was assessed by building professionals to test its structures viability about environmentally sustainable design issues and economic factors (building costs). Building professionals were also asked to give their opinions about the feasibility of environmental and educational features of outdoor classrooms, in response to the photographs in the questionnaire (Appendix H, Section B and C). They were asked to take into consideration climatic comfort and to give their opinions about the climatic performance of the open-air teaching and learning model and the site design model as an evaluation of the open (but roofed) classroom prototype developed for this study. As only six professional practitioners were interviewed, it is difficult to extrapolate these findings to the broader Malaysian context. However, the comments of these professionals provide a valuable perspective across a broad range of professions related to architectural issues. It was considered that this sample would provide an adequate basis for an understanding of professional views in this area. In addition, participants were selected based on their level of experience and involvement in and knowledge of government primary school design.

The Key Assessment Criteria derived from the data provided by the stakeholders' responses to Section E, Question 1, Part 1 of the questionnaire in Part 6 (refer to Appendix H, Questionnaire) were used to evaluate the model.

Part A

5.3.1 Site survey analysis of primary schools

Due to the Malaysian Education Act restrictions, permission was not granted by the relevant government body (Ministry of Education) to take photographs. Thus, the descriptions of the schools were undertaken mainly by visual observations. Other descriptions were based on the data collected from the questionnaire. The three selected school samples are similar in building façade treatment, height, materials and planning. They differ in site, size, vicinity, demographics, surroundings, opportunities and problems.

It must be noted here that the definitions of 'suburban' and 'urban' environments as used in this study may differ from the accepted definition of these terms in Western urban design literature. The terms as used to represent the present state of developing Malaysia (and corresponding South-East Asia countries) where 'suburban' areas are developing with high-rise public or private housing on the perimeter of larger towns, and 'urban' areas are either 'reclaimed' urban land close to the centre of the existing towns, or zones of affluent low-rise town houses in new satellite towns, close to the city centre.

5.3.2 The rural school

This school is situated in a rural village, surrounded by houses made of timber, on twelve acres of flat land, facing mountains and tropical greenery and with a stream and domestic animal farms within walking distance. There are about 1,000 mainly Malay families living in the village; many residents work in clerical positions. The school buildings are surrounded by tarmac hard standing for staff car parking areas, enclosed with two metre galvanised mild steel fencing with barbed-wired on top to keep out trespassers.

5.3.3 The suburban school

Situated on the fringe of a capital city on a three acre site, this school is surrounded by mixed housing ranging comprising expensive expatriate high-rise elite condominiums (more than 20 storeys); expensive residential housing, such as bungalows; serviced-apartments (10 storeys); medium-cost flats (5 storeys); and one and two storey detached residential houses. There is no formal landscaping at all in this school, except for turf and tarmac for car parking.

5.3.4 The urban school

Located on a professionally planned ten acres site, in a satellite city with complete urban facilities, this is the only school in this study attached to a secondary school. It is set within a residential area of detached single storey houses. There are many mature trees, turf areas, sand pits and tarmac car parks in the vicinity. The general characteristics of the schools sampled in the research are listed in Table 5.1.

Table 5.1: A synopsis of current Malaysian primary schools

Setting	Rural school	Suburban school	Urban school
Coeducational	Yes	Yes	Yes
Students Socio-economic background	Varied	Varied	Varied
School funded by	Government	Government	Government
School curriculum	Government	Government	Government
Academic achievement	Excellent	Average	Poor
Building's aesthetic value	Excellent	Poor	Poor
Building climatic factors	Comfortable Due to proper design of spacing and landscaping.	Comfortable due to dense existing vegetation	Uncomfortable
School grounds ecological values	None	Excellent	Minimal
School grounds maintenance	Excellent	Poor	Average
School building safety	Safe, due to drawing standards approval.	Safe, due to drawing standards approval.	Safe, due to drawing standards approval.
Need for improvements	Additional use of school grounds as learning area required.	Additional use of school grounds as learning area and maintenance required.	Additional use of school grounds as learning area and maintenance required.

5.3.5 Results from the Post Occupancy Evaluation in primary schools

There were two sample groups surveyed. The first consisted of teachers from three government funded primary schools in Kuala Lumpur, comprising a rural school, suburban school and an urban school. Thirty six questionnaires were hand-delivered and there were thirty two participants; twelve from the rural school, thirteen from the suburban school and seven from the urban school (N=32).

The second sample group was drawn from current professional practitioners involved in school administration, planning, designing, building, costing and maintenance. There were six participants (N=6) in this category: an education administrator, an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. Altogether there were a total of thirty eight participants (N=38) in this group. Two types of data were produced from the questionnaire: qualitative and quantitative. The results are presented in coded form in Table 5.2.

5.3.6 Results of the questionnaire survey

Table 5.2 provides detailed demographic information concerning the teachers surveyed at the three schools. For all schools surveyed, female participants were significantly in the majority (75 percent) female compared with (25 percent) male.

Table 5.2: Demographic characteristics of participants from 3 schools (N=38)

Categories	Rural school (n=12)		Urban school (n=13)		Suburban school (n=7)		Professional Practitioners (n=6)	
Gender	Male (n=2)	Female (n=10)	Male (n=5)	Female (n=8)	Male (n=1)	Female (n=6)	Male (n=2)	Female (n=4)
Mean age (years)	25	24	22	22.5	20 to 30	31 to 40	41 to 50	25
Mean qualification	'0' level	'0' level and Teaching Certificate	Not mentioned	Between Certificate and Diploma	Certificate	Between Certificate and Diploma	Post-graduate Diploma	Post-graduate Diploma
Mean experience (years)	5	5.3	4.4	3.77	3	11.7	22.5	15

The mean experience levels for each of the participant categories are diverse, as indicated in Table 5.2. Female teachers in suburban schools had the oldest mean age (31 to 40) whereas most males in this category were aged between (20 to 30 years). In addition, female suburban schoolteachers had the longest mean experience (11.7

years), whereas males had only three years mean experience, which was the least amount for any category. The rural primary school teachers ranked second in mean age (25 for males and 24 for females). The mean experience in rural primary schools also ranked second (5 years for male and 5.3 for females). The urban schoolteachers had the least mean experience (4.4 years for males, compared to 3.77 years for females) and the youngest mean age (22 years for female and 22.5 for males).

Teaching qualifications varied across the three types of school. Generally, female teachers are better qualified and have more experience, except for urban schoolteachers where males are more experienced. Table 5.3 describes teachers' perceptions of comfort zones in primary classroom.

Table 5.3: Samples of year group taught indicating comfort/discomfort (N=32)

Categories	Rural school (n=12)		Urban school (N=13)		Suburban school (n=7)	
Gender	Male (n=2)	Female (n=10)	Male (N=5)	Female (n=8)	Male (N=1)	Female (n=6)
Average year level taught	5	3	4	3	4	3
Perceived teaching comfort zone						
8:00-10:30 am			2		1	2
11:00-1:00 pm				3		
1:30-4:00 pm	1	6				
4:30-6:30 pm						
Perceived teaching discomfort zone						
8:00-10:30 am						
11:00-1:00 pm						4
1:30-4:00 pm			3			
4:30-6:30 pm	1	4		5		
Teaching spaces preferences						
Indoors		10	5			
Outdoors	2			8	1	6

Key: 8:00-10:30 am (1), 11:00-1:00 pm (2), 1:30-4:00 pm (3), 4:30-6:30 pm (4) and Indoors (1) and outdoors (2)

The majority of male rural participants teach Year 5, 16.7 percent, whereas the majority of female rural participants 83.3 percent teach Year 3. In the suburban school the majority of male participants 14.3 percent teach Year 4 and the majority of female rural participants 85.7 percent teach Year 3. However, in the urban school, male participants 38.5 percent teach Year 4 and female participants 61.5 percent

teach Year 3. Hence, generally males teach upper primary grades and females teach lower grades across the three schools.

As indicated in Table 5.3, perceptions of comfort zones and when they occur during the school day vary according to the gender of the teachers and the type of school. In the rural school, comfort teaching zones and discomfort teaching zones for male and female teachers are perceived as being the same: from 1:30 pm to 4:00 pm (1 male and 6 females) and from 4:30 pm to 6:30 pm (1 male and 4 females) respectively. Similarly, in the suburban schools, perceptions of the comfort zone teaching time for male and female teachers also concur: from 8:00 am to 10:30 am (1 male and 2 females) in the morning session, whereas the discomfort teaching zone is from 11:00 am to 1:00 pm (4 females only).

However, in the urban school, there are time variations in comfort levels perceived by male and female teachers. Comfort zone teaching times differ as follows: male teachers preferred from 8:00 am to 10:30 am (2 males) in the morning and female teachers preferred from 11:00 am to 1:00 pm (3 females). The discomfort teaching zone was perceived by male teachers as being from 1:30 pm to 4:00 pm (3 males) whereas female teachers perceived the discomfort zones as occurring between 4:30 pm to 6:30 pm (5 males).

In addition, the questionnaire data suggest (as detailed in Table 5.3) that preferences for teaching and learning spaces are affected by gender and location of school. In the urban school, male teachers tend to prefer indoor classrooms (5 males) to their female counterparts, who prefer outdoor teaching (8 females). Male teachers in the rural school reflected the opposite preferences for teaching spaces as their urban counterpart (2 male votes for outdoors and 10 female votes for indoors). However, both male and female teachers in the suburban school expressed a strong preference for outdoor teaching and learning spaces (1 male and 6 females). The teachers may have influenced each other while answering the questionnaire in groups.

Tables 5.3, 5.4 and 5.5 contain a summary analysis of preferences for teaching spaces in response to the question of whether the subjects should be taught outdoors. This analysis is based on data collected from thirty eight participants in the survey

questionnaire, where brief answers to the above questions were provided by teachers (N=32) and professionals practitioners (N=6) who justified their selections based on a Likert scale of 1 to 5, with 1 signifying 'strongly agree' and 5 signifying 'strongly disagree'.

Table 5.4: Teachers' preferences for teaching outdoors
On a Likert scale of: Strongly Agree (1), Agree (2), Not Sure (3), Disagree (4) and Strongly Disagree (5) (N=32)

Subjects	Categories	Rural school (n=12)		Suburban (n=7)		Urban school (n=13)	
Gender		Male (n=2)	Female (n=10)	Male (n=1)	Female (n=6)	Male (n=5)	Female (n=8)
Languages (English and Bahasa Malaysia)							
Strongly Agree		2					
Agree			4		5	5	6
Not Sure			6		1		
Disagree				1			
Strongly Disagree							2
History							
Strongly Agree		2	3				
Agree			7	1	6	5	8
Not Sure							
Disagree							
Strongly Disagree							
Religious Education							
Strongly Agree		2	2			1	
Agree			6		6	4	
Not Sure			2				5
Disagree				1			3
Strongly Disagree							
Geography							
Strongly Agree		1	8	1	1		8
Agree		1	2		5	1	
Not Sure						4	
Disagree							
Strongly Disagree							
Science							
Strongly Agree		2	10	1	6		
Agree						5	8
Not Sure							
Disagree							
Strongly Disagree							
Mathematics							
Strongly Agree							
Agree		2	8		1	5	5
Not Sure			2		5		3
Disagree							
Strongly Disagree				1			
Art, Drama & Music							
Strongly Agree			10	1	6	1	8
Agree						4	
Not Sure		2					
Disagree							
Strongly Disagree							
Life Skills							
Strongly Agree			10	1	6	5	8
Agree		2					
Not Sure							
Disagree							
Strongly Disagree							

The question of whether the subject taught affected teachers' preferences for teaching indoors or outdoors is addressed in Table 5.4; the analysis of preferences is based on subject and gender. Indicated preferences for teaching outdoors varied according to the subject taught as well as the teacher's gender. In the rural school, all male languages teachers 'strongly agreed' (2 male teachers) that outdoor teaching would be preferable, whereas majority female languages teachers were 'not sure' (6 female teachers) and 'agreed' (4 female teachers) whether subjects such as languages should be taught outdoors. For the suburban school, a male languages teacher 'disagreed' with the idea whereas majority female teachers 'agreed' (5 female teachers) compare to a female teacher who was 'not sure' languages could be taught outdoors. In the urban school, both majority male and female teachers 'agreed' (5 male and 6 female teachers) and 'strongly disagreed' (2 female teachers) that languages subjects should be taught outdoors.

History teachers, in the rural school, reflected a slight difference of opinion between the sexes, whereby both male teachers 'strongly agreed' (2 male teachers) compared with females who 'agreed' (7 female teachers) and 'strongly agreed' (3 female teachers) with the use of outdoor teaching spaces. In the suburban school (a male and 6 female teachers) and the urban school (5 male and 8 female teachers), all female and male history teachers 'agree' for outdoor classroom teaching of history.

For religious education, both male rural school teachers 'strongly agreed' compared with their most female counterparts, who 'agreed' (6 female teachers), 'strongly agreed' (2 female teachers) and 'not sure' (2 female teachers) to outdoor classroom use for this subject. The suburban male school teacher who taught religious education 'disagreed', compared with all the female teachers who 'agreed' (6 female teachers) with outdoor classroom teaching for religious education subjects, whereas most male teachers in the urban school religious education area 'agreed' (4 male teachers) and a male teacher 'strongly agreed' compared with females who were mostly 'not sure' (5 female teachers) and 'disagreed' (3 female teachers) about outdoor classroom teaching of religious education subject. Overall, teachers had mixed opinions about teaching outdoors in the religious education subject.

Male and female geography teachers in the rural school 'strongly agreed' (8 female teachers) and male and female teachers 'agreed' (2 female teachers) that the subject should be conducted outdoors, whereas in the suburban school the male and female geography teachers 'strongly agreed' and another group of female 'agreed' (5 female teachers), compared with all female teachers who 'strongly agreed' (8 female teachers), a male who 'agreed' and 'not sure' (4 male teachers) in the urban school that geography subjects should be performed outdoors.

Science teachers' preferences for type of classroom were as follows: both the rural (2 male and 10 female teachers) and suburban (a male and 6 female teachers) schools, male and female teachers 'strongly agreed' compared to the male and female urban school science teachers who 'agreed' (5 male and 6 female teachers). Overall there was general agreement that science could usefully be taught outdoors.

Both male teachers teaching mathematics in the rural school 'agreed' with conducting the subject outdoors, compared with their female counterparts who were 'not sure' (2 female teachers) and 'agreed' (8 female teachers). While in the suburban school, the male teacher 'strongly disagreed', compared with the one female teacher who 'agreed' and 'not sure' (5 female teachers), whereas in the urban school, male and females teachers 'agreed' (5 male and female teachers), compared with females who were 'not sure' (3 female teachers). Thus, the idea of teaching mathematics outside was problematic for some teachers.

Art, drama and music teachers were in broad agreement regarding the suitability of outdoor teaching spaces for their subject areas. In the rural school, both male teachers were 'not sure', compared with all female teachers, who 'strongly agreed' (10 female teachers). Male and female suburban school teachers 'strongly agreed' (6 female teachers), whereas in the urban school, male and female teachers 'strongly agreed' (8 female teachers), compared with males who 'agreed' (4 male teachers).

For subjects such as life skills, in the rural school both male teachers 'agreed' with teaching outdoors compared with all female who 'strongly agreed' (10 female teachers) whereas all teachers in suburban (a male and 6 female teachers) and rural (5 male and 8 female teachers) schools 'strongly agreed' with using outdoor

classrooms for this subject. Thus, life skills were generally regarded as highly suitable to be taught outdoors by the majority of teaching staff members.

5.4 Results of the survey of professionals

There were six participants in this category: an education administrator, an urban and regional planner, an architect, a landscape architect, a quantity surveyor and a mechanical engineer. There were four responses from females (66.6 percent) in the professional category, as follows: the education administrator, the landscape architect, the quantity surveyor and the mechanical engineer. Only two male professionals responded (33.3 percent), an urban and regional planner and an architect.

In the category of professional practitioners, males ranked as considerably older (41 to 50) than females (25 years old) and were also more experienced (22.5 years mean experience for males, compared with 15 years for females). The mean qualification for both male and female professional practitioners is a Postgraduate Diploma (6) in each profession (refer to Table 5.2).

Overall, both male professional practitioners were 'not sure' whether teaching languages outdoors would be advantageous, compared with females who 'strongly agreed' (4 females) that language subjects should be taught outdoors.

Both male professional practitioners were 'not sure' compared with a female who 'strongly agreed' and 'not sure' (3 females) that history should be taught outdoors. Thus, generally there was support for the idea of teaching history outdoors from the female professional practitioners. In religious education, all male professional practitioners were 'not sure' compared with female professional practitioners who 'strongly agreed' (3 females) and one female 'agreed' with the subject being taught outdoors.

All male professional practitioners were 'not sure' that geography should be taught outdoors, compared with all female who were 'strongly agreed' (4 females). Both male

professional practitioners were 'not sure' compared with a female who 'agreed' and another group 'strongly agreed' (3 females) with science being taught outdoors.

The two male professionals practitioners, 'disagreed' compared with females who 'strongly agreed' (3 females) and another one 'agreed' that mathematics should be taught outdoors.

Both male and female professional practitioners 'strongly agreed' (4 females) with increased outdoor classroom use for subjects such as art, drama and music.

Professional practitioners also 'strongly agreed' (2 males and 4 females) with using outdoor classrooms for teaching life skills.

Table 5.5: Professional participants' views on teaching outdoors
 On a Likert scale of: Strongly Agree (1), Agree (2), Not Sure (3), Disagree (4) and
 Strongly Disagree (5) (N=6)

Categories		Professional Practitioners (N=6)	
Gender		Male (n=2)	Female (n=4)
Subjects			
Language (English and Bahasa Malaysia)			
Strongly Agree			4
Agree			
Not Sure		2	
Disagree			
Strongly Disagree			
History			
Strongly Agree			1
Agree			3
Not Sure		2	
Disagree			
Strongly Disagree			
Religious Education			
Strongly Agree			3
Agree			1
Not Sure			
Disagree		2	
Strongly Disagree			
Geography			
Strongly Agree			4
Agree			
Not Sure		2	
Disagree			
Strongly Disagree			
Science			
Strongly Agree			3
Agree			1
Not Sure		2	
Disagree			
Strongly Disagree			
Mathematics			
Strongly Agree			3
Agree			1
Not Sure			
Disagree		2	
Strongly Disagree			
Art, Drama & Music			
Strongly Agree		2	4
Agree			
Not Sure			
Disagree			
Strongly Disagree			
Life Skills			
Strongly Agree		2	4
Agree			
Not Sure			
Disagree			
Strongly Disagree			

5.4.1 Participants’ views on current teaching and learning spaces

Questions 1 and 2 in Section C of the questionnaire asked the participants for their views on the current status and future development of quality teaching and learning spaces in government funded primary schools in Malaysia. Survey respondents listed a variety of suggestions, which could be categorised in several ways. However, the responses have been broadly categorised as apparently negative in direction and apparently positive. Participants’ negative and positive (refer to Appendix J, Tables 5.7 to 5.12) responses were assessed by the keywords they used to describe the current quality of teaching and learning spaces, as listed in Tables 5.6 and Table 5.10. This assessment is additionally supported by words identified as used by the participants in this context, as described in Tables 5.7 to 5.10.

To arrive at the categories of responses shown in Table 5.6, keywords used by participants were examined. These appeared to fall into three distinct categories respectfully related to ‘controlling,’ ‘exam orientated’ and ‘boring,’ as described in Tables 5.7 to 5.9.

Table 5.6: Keywords frequencies and percentage responses from teachers

Current quality of teaching and learning spaces	Percentage frequency
Controlling	50
Exam orientated	30
Boring	20
	100.00%

Table 5.7: Keywords indicating 'Controlling' 50% (N=38)

Question 1, Section C: Based on your professional experience please give your views, on the existing primary school design

Categories	Rural school n=12 (30.76%)	Urban school n=7 (20.5%)	Suburban school n=13 (33.36%)	Professional Practitioners n=6 (15.38%)
Controlling (50%)	unsuitable subjects discipline hyperactive restriction detention concentrate curriculum disobedient bell still talking naughty undynamic	focus attention playful class mood uniformity traditional backward quiet rigid exposure unmoveable strict uninfluential	spoon-fed heat-stress time limit mind reading not applicable no freedom restricted movement prison distant powerless gap differentiation varieties	senseless rigid prototype too formal regimented army non-creative command sterile solemn surroundings identical stagnant inhumane

Key: Indicated by Coded response keywords, listed by percentages

Table 5.8: Keywords indicating 'Exam orientated' 30% (N=38)

Categories	Rural school n=12 (30.76%)	Urban school n=7 (20.5%)	Suburban school n=13 (33.36%)	Professional Practitioners n=6 (15.38%)
Exam orientated (30%)	no life interaction single communication Unsuitable lessons Future orientated unbalanced expectation not child friendly borrowed nature teacher focused	not well-equipped less satisfying less acceptance number assessment competitive results backward nerd sterile knowledge	time restrictions government needs paper qualification non-experimental secondary school market non-experiential learning memories not memorable obey one's elders	unsafe no real picture too formal no sense of self regimented thinking government mentality less critique too academic price grant

Key: Indicated by Coded response keywords, listed by percentages

Table 5.9: Keywords indicating 'Boring' 20%(N=38)

Categories	Rural school n=12 (30.76%)	Urban school n=7 (20.5%)	Suburban school n=13 (33.36%)	Professional Practitioners n=6 (15.38%)
Boring (20%)	chalk and talk sleepy students dull surroundings restricted curriculum gullible indoor lesson no life examples monotonous no comment no questions	Government product focused attention span is less than 20 minutes dull uniformity disabled technique square nerdy desolate sameness no feedback no talking in class	no learning and play no childhood physical and emotional development lazy attitude acceptance without thinking bleak environment crowded talking alone	vandalism high maintenance not informal space limitation dull space mundane environment no character monotonous too well-ordered

Key: Indicated by Coded response keywords, listed by percentages

Table 5.10: Keywords frequencies and percentage responses from teachers

Future outdoor teaching and learning spaces.	Percentage frequency
Provide amenities aids	80
More space	20
	100.00%

The keywords supporting the use of future outdoor teaching and learning spaces are listed below in Tables 5.11 and 5.12. They list positive keywords derived from the questionnaires and interviews.

Table 5.11: Keywords indicating 'Amenities' 80% (N=38)

Categories	Rural school n=12 (30.76%)	Urban school n=7 (20.5%)	Sub-Urban school n=13 (33.36%)	Professional Practitioners n=6 (15.38%)
Amenities aids (80%)	state of the art life long learning facilitating culture sensitive better understanding instilling knowledge natural surroundings examples memorable lasting impression	more learning aids outdoor interaction skillfull psychology teaching and learning facilities behavioural education outdoor stimulation for weaker students self assessment	environment for enquiry inquisitive investigation inventory interesting colourful challenging sensitive mind mapping trailing believing seeing sports	equipment anti-vandalism expressionist source inspirational senses alertness process cognitive experiential learning outdoor application

Key: Indicated by Coded response keywords, listed by percentages

Table 5.12: Keywords indicating 'More spaces', 20% (N=38)

Categories	Rural school n=12 (30.76%)	Urban school n=7 (20.5%)	Sub-Urban school n=13 (33.36%)	Professional Practitioners n=6 (15.38%)
More spaces (20%)	flexible stimulating culture sensitive applicable everywhere applicable for all abilities wider view meaningfull borderless knowledge freedom nature exploration no limit	combine subjects extra curricular space ergonomic or anthropometric Time capsule outdoor interaction adventurous wider bigger more headroom spacious not confined expedition exploration	outward bound extra classes challenging echo performances water bodies wildlife insectarium butterflies greenery serene landscaping picturesque noise spooky	Security (CPTED) humane external space overflow space informal space influential setting homely hide-out sense of place or space sense of belonging sense of identity/character

Key: Indicated by Coded response keywords, listed by percentages

From all the responses there emerges a clear preference for reinstating outdoor classrooms (80 percent) in order to create a better education environment in government funded primary schools in Malaysian than exists at present. Tables 5.11 and 5.12 show that a significant percentage of teachers felt that there should be increased outdoor teaching 30.76 percent of rural primary school teachers, 33.36 percent of suburban primary school teachers and 20.5 percent of urban primary school teachers as described by different keywords for each group). However, a lower percentage of building professionals shared this view only (15.38 percent).

The keywords in Table 5.10 suggest that, currently, the classroom environment is typically unstimulating and monotonous. It is not student-centred and from an architectural viewpoint, is high maintenance, crowded, formal and mundane. On the other hand, the keywords listed in Tables 5.11 and 5.12 suggest that if school grounds' area permits, outdoor classrooms could be sited close to the main school building complex. The surrounding spaces could provide teaching, learning and

playing opportunities for conducting lessons in government funded primary schools in Malaysia.

Participants were asked to give their thoughts about the quality of teaching and learning spaces in government funded primary schools in Malaysian. This is presented in Section E of the questionnaire as follows:

Section E

Question 1: Please give your view on the current quality of teaching and learning spaces and how they envisage future developments in Malaysia.

Question 2: Please give your view on how you see the development of future teaching and learning spaces in Malaysia.

As indicated by the responses listed below, the answers to these questions supported the findings of the qualitative data that majority percentage of teachers felt that outdoor classrooms would contribute to the Malaysian education system, better than the present classroom design (refer to Tables 5.3 and 5.4).

5.4.2 Results of Investigative Issues

Overall, Investigative Issues 1, 2 and 3 address the first Key Assessment Criteria—Cultural influences (refer to Figure 4.1), which explores the following themes:

5.5 Investigative Issue 1: The ways in which government funded primary schools incorporate and use outdoor space.

Teachers and building professionals responses to the questionnaire and survey, indicate that currently only subjects such as sports and recreation are conducted outdoors, if weather permits.

The following statements express the feelings of participants about the current classrooms: “Does not allow any outdoor learning” (Year 6, male, rural school teacher, aged 20 to 30, with 4 years experience); “Syllabus does not include outdoor activity” (Year 1, female, rural school teacher, aged 20 to 30, with 3 years experience); “Schools usually own 1 television, 1 video and limited space for

outdoor teaching and learning” (Year 5, female, suburban school teacher, aged 31 to 40, with 9 years experience).

5.6 Investigative Issue 2: How stakeholder views reflect current thinking in education

Teachers were aware that a spirit of learning through play (Manan, 1998) could be incorporated more effectively in outdoor spacious classrooms, overcoming the boredom experienced by children in indoor classrooms at present. The outdoor environment also can be not just a place for play activities but for students to learn through play. This view is supported by the International Playground Association (IPA) in its Declaration of the Child’s Right to Play presented at the United Nations. This declaration spelt out specific concerns about contemporary education and lack of play opportunity and called attention to several alarming trends, which lately are affecting children. The IPA is deeply concerned by a number of identified negative impacts on children’s development, such as a lack of social skills (refer to Section 3.9.3).

Teachers’ statements showed their awareness of the importance of a student-centred approach to teaching and learning action and that this would be facilitated by improved use of space. For example: “Students should be given a chance to choose a learning environment based on their interest and abilities so that their interest is sustained and they do not get bored so easily” (Year 4, female, urban school teacher, aged 31 to 40, with 14 years experience); “At present, students get bored and sleepy easily and there is not much chance for students to play and learn which stay focused simultaneously” (Year 4, female, rural school teacher, aged 20 to 30, with 2 months experience).

Some teachers, however, were not aware that teaching should be student-orientated, rather than teacher-orientated. Interestingly, teachers who stressed the importance of control were not particularly interested in students’ needs. Some teachers still regarded discipline as the primary factor in designing teaching spaces as illustrated by the comment: “The current teaching and learning space allows a big number of increasing students. Their discipline and focus can be controlled. It is suitable for

subjects related to reading and theory” (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience). Others, however, recognised the unsatisfactory nature of the current space and saw it as inadequate to control students. As one teacher commented: “The current teaching and learning space is not a comfortable place for teachers and it is hard to control students” (Year 4, female, rural school teacher, aged 20 to 30, with 2 months experience).

In addition, some teachers recognised that the school architecture was making it difficult to introduce new and innovative pedagogy into government funded primary schools teachers, because of the limitations imposed by the buildings. The following statement illustrates this:

Indoor classrooms are suitable for certain subjects only, because the concentration time of primary school students, aged from 7 to 12, is 20 minutes only for each learning session. Thus teachers usually choose the indoor environment in order to maintain the on-task focus of students. (Year 4, female, urban school teacher, aged 31 to 40, with 14 years experience);

Another teacher pointed out that, the usefulness of the current space was extremely limited:

The present space is effective for a small number of students. If more, their discipline and focus are not easily controlled by the teacher. It is not suitable for practical subjects, or those related to nature. (Year 4, female, rural schoolteacher, aged 20 to 30, with 3 years experience)

5.7 Investigative Issue 3: Issues relating to the development of an external classroom model.

This model was based on the data from the literature review, which details:

- The historical influences on Malaysian school education.
- Significant historical examples of outdoor teaching and learning both in Islamic and European educational history.
- The extant research into children’s cognitive development and human geography.

The results of the literature review revealed that the primary school curriculum was based on the presumed needs of the majority of the Malaysian population who were indigenous Malays. It was also based on the established British Colonial Education

System (The Education Ordinance 1957). Since 1957, the Malay vernacular school system, derived from the British system, was retained with the Islamic influence included in the school curriculum. The ideal Islamic educational philosophy is environmental and friendly but the official Malaysian education curriculum does not address or emphasise this issue.

As demonstrated by the literature review, traditional Islamic education incorporates outdoor space. The purpose of this, from a religious perspective, was to facilitate communication and understanding and to reinforce the relationship between humankind (*hablu min nan nas*) and between humankind and the Creator (*hablu min allah*) as well as between humans and Creation (the environment) (*hablu min nal alamin*), as specified in the Quran (Al-Hilly and Mushing, 1993). This is similar to *panya*, *samanthi* and *sila* in Buddhism, as described in Section 3.7.6.

The three religious education teachers who participated in the questionnaire supported the above view, indicating that reinstating external classroom space would help develop children's awareness that humans' responsibility for their environmental inheritance is an intrinsic focus of Islam, requiring them to care for the environment in order to pass it on to the future generations. Most teachers (refer to Tables 5.3 and 5.4) generally expressed support for increased use of external classroom space as supported by the quotations below, drawn from one questionnaire response:

Students can concentrate and understand their subjects better with the help of teaching and learning aids from the environment, especially in subjects such as religious education (showing the Creator's creation); The same is true of English subjects (using trees and plants as examples), Mathematics in the early years and, Physical and Health education (Year 3, gender urban school teacher, aged 20 to 30, with 1 year and 8 months teaching experience).

Most teachers surveyed supported the reinstating of external classroom space in the Malaysian education system for educational reasons, including the improvement of the learning outcomes, for to a number of factors. Historical precedence was cited by one History teacher with the statement that: "...in the case of learning spaces in Malaysia, studying outdoor was adopted long ago, however, it has diminished as

more modern buildings have been built” (Year 1, female, urban school teacher, aged 20 to 30, with 1 year teaching experience).

The teachers in the questionnaire answers frequently noted problems arising from indoor teaching. There were (20 percent) of respondents listed boredom as an issue (refer to Tables 5.6 and 5.9) and lack of space was noted by (20 percent), (refer to Tables 5.10 and 5.12) as significant. Many teachers perceived significant advantages of teaching in outdoor classrooms, included the following: “It would be preferable to give students chances to do outdoor activities including suitable teaching and learning through curriculum “ (Year 1, female urban school teacher, aged 20 to 30, with 4 years experience).

Some teachers expressed concern about the connection between teaching spaces and learning outcomes, for example:

In a situation where there are too many students in classroom the flow of teaching and learning is disturbed. There should be a special syllabus for weaker students so that proper attention can be focused on them. Students try to avoid thinking at school. Knowledge in school is not applied at home. Students easily give up searching for answers in a problem form (Year 4, male, suburban school teacher, aged 20 to 30, with 3 years experience).

Students are also inevitably affected by their teachers’ negative perceptions about the teaching and learning space in the current ‘control and exam orientated’ scenario in the indoor classroom. An indication of the extent of teachers’ negative feelings towards current indoor teaching spaces also revealed by the high percentage of negative responses (20 percent) described in Tables 5.6 and 5.9, to describe the current teaching and learning spaces present by the participants, where (20 percent) of teachers surveyed used the keyword ‘boring’.

In contrast, other statements reflected teachers’ optimism about the positive qualities of outdoor teaching spaces. For example: “Outdoors classrooms could create an atmosphere conducive to teaching and learning in the environment” (Year 4, female suburban school teacher, aged 31 to 40 years, with 14 years experience).

Building professionals shared the teachers' views about the negative effects of the present teaching space as expressed by the following comments: "Standard design, dull and not creative" (architect); "Before building schools the location should be identified as a proper setting because it can influence childrens' achievement" (mechanical engineer), and "Besides having good external spaces in the primary school, the learning content, also should include field trips to exciting places to stimulate the students' mind" (landscape architect).

Teachers' comments about the negative effects of indoor classrooms reflected their awareness of recent pedagogical theory, which is not yet generally reflected in Malaysian school architecture. For example: "To be in classrooms all the time can make students and teachers bored and cause teaching and learning to be dull" (Year 2, female, urban school teacher, aged 20 to 30, with 4 years experience); "With outdoor classrooms, boredom is avoidable" (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience).

It is apparent from the results in the above areas that changes in attitude towards teaching and learning are required in order to initiate changes in architecture. Thus, a new paradigm is needed which reflects the latest pedagogy, based on research into how children learn, with design solutions that address Malaysian climatic issues and ESD concerns.

5.7.1 Practitioners' perceptions of education in Malaysia

The statement above supports arguments for environmental change in government funded primary schools today. Changes in architecture alone are not enough to improve educational outcomes. Before this can occur, as indicated by many teachers' responses, acceptance of a new paradigm needs to occur at the official level.

However, the results of the questionnaire indicated that teaching practitioners in Malaysia generally have the view that the educational spaces currently in use produce certain desirable human behaviours and attitudes, and create desirable power relationships between teachers and students as illustrated by the comments following: "The current teaching and learning space is designed as a place to control students" (Year 4, female, rural school teacher, aged 20 to 30, with 3 years

experience); “The current situation allows good control of students by teachers and makes it easier for students to focus” (Year 3, female, suburban school teacher, aged 20 to 30, with 2 months experience). Lack of space and high student numbers have meant that efficient use of available space has been a main design priority, as one experienced teacher pointed out:

The teaching and learning method is focused on indoor learning, because of the large number of students (35 to 45) and the poor staff to student ratio (Year 5, female, rural school teacher, aged 41 to 50, with 18 years experience).

In addition, classrooms are not well resourced, as an urban teacher stated:

The current quality of teaching and learning spaces in Malaysia is not very good due to lack of necessary facilities in classroom thus causing difficulties in controlling classes’ (Year 2, female, urban school teacher, aged 20 to 30, with 2 months experience).

The need to control students was seen as a high priority in teachers’ comments, as well as occurring frequently in the keywords analysis. Words such as ‘exam orientated’ also frequently appeared with frequency (30 percent), refer to Tables 5.6 and 5.8. However, teacher awareness of the inadequacy of this method of assessment alone is growing as indicated by the following comment: “The exam orientated method is not applicable to daily life” (Year 5, female, rural school teacher, aged 31 to 40, with 9 years experience).

Teachers’ views about the purpose of education were often outdated in terms of recent Western pedagogy. However, some teachers were aware that this approach to education is currently regarded as extremely limited, as indicated by the following teachers’ comments: “The present system is based on paper qualifications and is exam orientated for future markets. Social and moral values are disregarded. Merit is based on good grades, not morality” (Year 4, male, rural school teacher, aged 31 to 40, with 6 years experience); “Education nowadays, is different from previously. More attention is given to academic achievement. Focus is on one aspect of specialisation. Before, all aspects of life learning operated concurrently” (Year 4, male, rural school teacher, aged 31 to 40, with 6 years experience).

Other teachers stressed the emphasis on exams rather than on developing social values in the Malaysian primary school curriculum, as indicated by the following

comments “Malaysian education is regarded as a preparation for exams. Thus, teaching quality improvements continue, but with limitations” (Year 1, female, rural school teacher, aged 31 to 40, with 8 years experience).

Overall, the majority of teachers’ views were reflective and discriminating. Among the hopes for the future were improvements in education amenities. Teachers are also becoming more aware of the need for different types of learning experiences, involving: ‘Borderless knowledge’ and ‘attracting students interest.’

Teachers recognised the importance of classroom design in improving pedagogical innovation. For example, the following statements show teachers’ awareness of the teaching implications of seating arrangement guidelines in a space: “In classes, students should be in groups for discussion purposes in teaching and learning” (Year 5, female, suburban school teacher, aged 20 to 30, with 2 months experience); “The classroom or any teaching and learning area, needs to be more interesting and colourful” (Year 2, female, suburban school teacher, aged 31 to 40, with 9 years experience).

For the future, teachers’ hopes and expectations are reflected by their use of keywords, such as ‘amenities aids’ (80 percent) and ‘more space’ (20 percent), (refer to Tables 5.10, 5.11 and 5.12 for teaching and learning), as shown in the following statement “Indoor classrooms at present are suitable for certain subjects such as Mathematics and History only” (Year 1, female, rural school teacher, aged 20 to 30 years with 4 years experience).

In addition, a strong concern for and attraction to outdoor structures as an additional form of classroom was detected in the responses. This was confirmed by the large percentage of teachers who nominated the indoor classroom situation as ‘not comfortable’ in certain periods (refer to Tables 5.3 and 5.4), where overall affirmed that they would prefer outdoor teaching spaces.

Many statements by teachers supported the view that there was unequal distribution of resources between schools:

Some new suburban schools are well equipped with proper teaching and learning aids. Every class is equipped with 15 to 20 computers compared to other schools. Their surrounding environment is

reasonable too for outdoor purposes, which should be available in other schools too (Year 5, female, suburban school teacher, aged 31 to 40, with 9 years experience).

Several teachers expressed dissatisfaction with resource allocation. For example: “There are not enough teaching aids to ease teaching and learning” (Year 2, female, suburban school teacher, aged 41 to 50, with 25 years experience); “There is little satisfaction, due to not enough facilities” (Year 5, female, urban school teacher, aged 20 to 30, with 3 years experience).

There was general agreement by most teachers on this issue, as indicated by the following comments by two urban teachers:

Though Malaysia is considered to be a developed country, the quality of education is acceptable for second world nation standards; it varies through schools and locations. In urban areas, the quality should be upgraded, especially generally IT facilities (Year 1, female, urban school teacher, aged 20 to 30, with 1 year experience);

Overall, the teaching quality is good but the uniformity in distributing teaching aids is not equal (Year 1, male, urban school teacher, aged 20 to 30, with 2 years experience);

Two suburban teachers echoed this view:

The current quality of indoor teaching and learning spaces in Malaysia can be categorised as average, due to the lack of equipment, such as computers, television, radio and teaching aids (Year 5, female, suburban school teacher, aged 31 to 40, with 9 years experience).

A lot of facilities should be made available for students and teachers to use (Year 6, female, suburban school teacher, aged 31 to 40, with 9 years experience).

However, many teachers pragmatically felt that they would probably have to accept the situation and make do with less than adequate facilities. One teacher commented: “A lot of facilities can be manipulated for teaching and learning use” (Year 2, female, urban school teacher, aged 20 to 30, with 4 years experience).

Part B

5.7.2 The results of the Study Model

The development of the model involved the generation of a prototype school model for a number of roofed, but otherwise open, classroom structures arranged in clusters, with a naturally ventilated, enclosed classroom or amenity building in the centre of each cluster (this model was derived from Investigative Issues 4 and 5). (A comparison of the climatic performance of the proposed model with the performance of current government funded primary schools in Malaysia was undertaken with a view to developing a more appropriate model within standard Malaysian school sites and the perceived need for improvement of outdoor classrooms spaces). The majority of teachers, whose responses to the survey questionnaire indicated the potential of this spatial arrangement to produce better student interaction and understanding held views such as this:

Teaching and learning should be able to be performed outdoors because it is more interesting and will give more opportunities for students to explore nature (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience).

Also, the majority (refer to Table 5.5) of building professionals surveyed supported the re-instating of external classroom space in the Malaysian education system from an Islamic viewpoint. The mechanical engineer and quantity surveyor supported this concept from their professional viewpoints and experience, as indicated by a government architect's response:

A popular saying by the Prime Minister and Deputy Minister is that Malaysia has world-class facilities in buildings but a third world mentality. This is because there is so much money spent on to investing in buildings and technology but little is done in investing in people. In order to design schools, questioned should be ask of what kind of products needed to be produced by the schools. Do we want children who only excel in education but have no sense of belonging to their community and fellow beings? Children should be taught good values early in their life so that they become responsible people when they grow-up. They need to be responsible to their fellow beings and most importantly to their environment. This is basically the concept of beings a 'khalifah' (viceregent) over the natural environment, as is required by Islam.

The architect participants claimed that government funded primary school buildings are not designed for the climate and merely reflect conservatism. Furthermore, they believe they do not measure up to world standards of building. School buildings in government funded primary schools follow British school building architecture, which reflects early 20th century pedagogy, instead of the practical local Malaysian architecture and a teaching pedagogy suitable to the Malaysian way of life. As described earlier in the literature review, traditional Malay society was based on the '*halaqah*' (circle) method of teaching. According to Islam, children should be taught about environmental values as future inheritors of Allah's creation. In order to instil good environmental values, it is proposed in this research that they should be taught outdoors at least part of the time, to encourage maximum interaction at the earliest stage with nature.

Other participants considered that planning for teaching, learning and playing could be improved by the use of outdoor spaces, as indicated by a male teacher: "Teaching could be more effective, due to the variety offered by the outdoor environment, with opportunities to vary teaching strategies and techniques" (Year 1, male, urban school teacher, aged 20 to 30, with 2 years experience).

A minority of participants compared existing teaching and learning opportunities with their view of how the situation could be improved, for example, more flexible facilities were seen as a possible benefit of outdoor classroom use. For example: "A lot of facilities can be manipulated for teaching and learning use, if outdoors classrooms are available" (Year 5, female suburban school teacher, aged 31 to 40, with 9 years experience).

Most participants supported increased freedom and opportunity for students to enhance their teaching, learning and playing time. For example, one teacher commented: "Teaching and learning can be more effective and successful if students are allowed to go outside for certain teaching topics" (Year 2, female, urban school teacher, aged 20 to 30, with 4 years experience).

Other teachers also supported this view:

The surrounding environment is reasonable too for outdoor learning, which should be available in other schools too (Year 5, suburban female school teacher, aged 31 to 40, with 9 years experience); For the education system to be more comfortable and better for students, lessons should be focused on the outdoors, to change student's views (Year 2, rural female school teacher, aged 20 to 30 with 2 months experience).

All of the participants suggested that outdoor teaching and learning was practical, promoted independence and facilitated new ways of learning (refer to Tables 5.3 and 5.4):

Teaching and learning could be more spontaneous and natural in an informal interesting environment, with practical educational aids (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience).

It was generally perceived that learning opportunities would be improved by use of outdoor teaching spaces. As one teacher noted: "Give opportunities for students to do more activities outdoor and provide more learning aids to students so that they are more interested in learning" (Year 6, male, rural school teacher, aged 20 to 30, with 4 years experience).

Forty percent of participants (refer to Table 5.4) stressed student choice of learning environment as important for maintaining interest, for example: "Students should be given a chance to choose a learning environment based on their interest and abilities according to the subjects so that their interest is sustained and they do not get bored easily" (Year 4, female suburban school teacher, aged 31 to 40, with 14 years experience). The same teacher also stressed the importance of multi-culturalism and environmental education. She stated: "Teaching and learning should not only stress educational aspects, but also consider shaping the quality of students' behaviour."

Malaysia is a multi-cultural society with several mother tongue languages such as "Malay, Iban indigenous and Chinese mother tongues genuine and local environmental education uses the natural environment to consolidate the cultural influences which, shape childrens' way of thinking. The idioms [refer to Appendix G] from the various mother tongues in use in Malaysia show the linguistic basis underlying the connection with the environment, across ethnic groups"

(Year 3, female, rural schoolteacher, aged 20 to 30, with 7 years experience).

This information fits with the landscape architect's opinion about the value of learning from the environment. In the structural engineer's opinion, learning by doing can occur when building simple structures, either as students' group work only or as a family or community activity. The urban and regional planner agreed with the landscape architect and structural engineer's ideas, adding that it may improve crime prevention through environmental design, by applying these idioms to environmental design with security of the school grounds in mind. An environmentally sustainable design would produce economies (by using local building materials), which are suitable and affordable.

The urban and regional planner responded that a social impact assessment would be advisable, to determine whether this type of education would improve the community by making it closer and stronger by encouraging community activities, which are lacking (especially in cities) today. All three professional opinions indicated that increased use of outdoor classroom space could lead to reduce environmental impact and simultaneously a more environmentally aware approach.

5.8 Investigative Issue 4: A comparison of the climatic performance of the proposed model to the performance of current government funded primary schools.

Climatic performance

The schematic design of the open-air teaching and learning model generally follows the building design principles recommended by many authors (Olgyay, 1963, p.102; Fry and Drew, 1964, p.29; Siddique, 1977, p.105; Szokolay, 1980, p.331; Harris and Welke, 1982), (refer to Figures 3.5 to 3.6) for hot, humid climates. Essentially, the design consists of an elevated floor and an insulated roof with a combination of open and air-permeable fixed screen sides (refer to Figure 5.1).

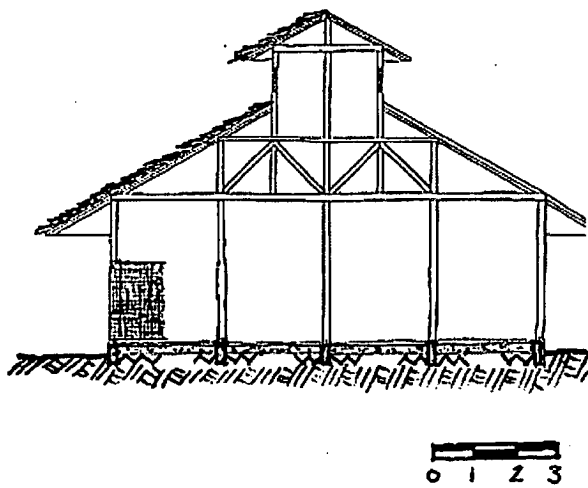


Figure 5.1: Prototype teaching modules (40 pupils)

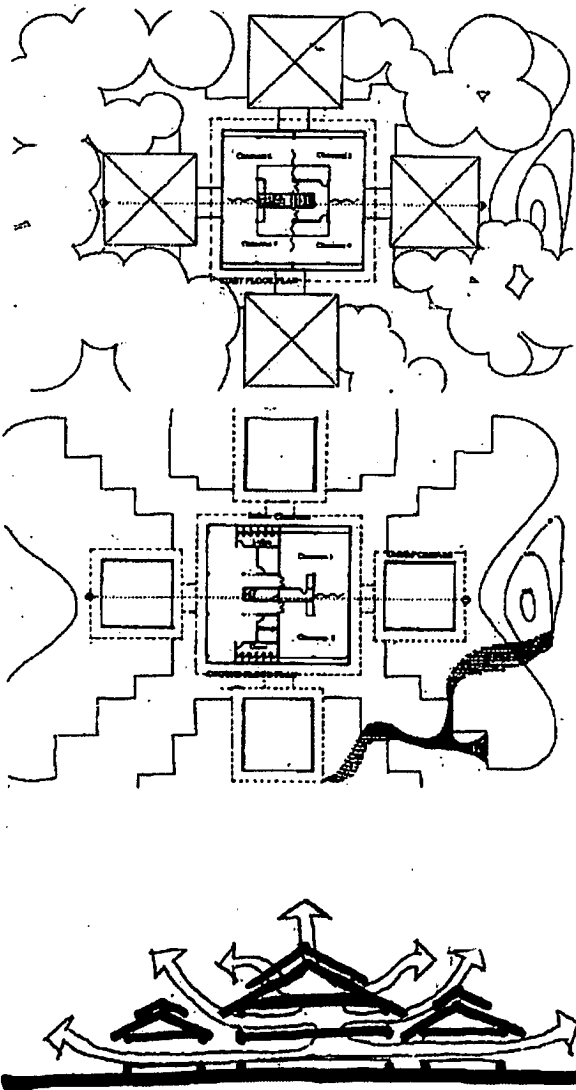


Figure 5.2: Plan and section for prototype modules (400 pupils)

Economic factors

The development of the research design school model on a real site was underpinned by both the survey analysis and the researcher's design interpretations. The model school made use of a medium cost structure (refer to Appendix D, Types 6, 8, 9, 24, 26, 36 and 38) for the open-air classrooms. This building type has quality finishes and an aesthetic and functional link with traditional Malay buildings. Both the elevated, ventilated timber floor and the part-open, part-penetrable screen sides correspond to the building type recommended by most authors for climatically suitable building types for hot-humid tropical climates (Olgyay, 1963, p.102; Fry and Drew, 1964, p.29; Siddique, 1977, p.105; Szokolay, 1980, p.33; Harris and Welke, 1982; Wan, 2000).

Building materials and structures

The research design model was developed on a hypothetical site as a Study Model. It consisted of an open-air but sheltered (roofed) pavilion-type school design developed to test the feasibility of an alternative school building type on an existing Malaysian site. A ten metre by ten metre open-structured classroom model was developed, using a variety of materials and structures. The ten metre by ten metre model (100 square metres) was chosen as suitable in size for the average class size of forty pupils, providing 2.5 square metres of individual space for each pupil, including circulation and teacher's space. The teaching or demonstration space was estimated as requiring (20 percent) of the total area, which still provides two square metres of individual space for each pupil (individual and circulation space). This is comparable with the current Malaysian and International standards of 1.86 square metres to 2.4 square metres individual study space in standard classrooms (refer to Tables 5.13 and 5.14). The research model described in this chapter also attempts to provide an architectural validation for the use of outdoor classrooms in government funded primary schools from an economic viewpoint (refer to Appendix D).

Future expansion options and landscape quality opportunities

The model is based on arguments from pedagogy, supported on professional grounds by practitioners' views about current teaching, learning and play spaces. An analysis was made of educational space allocation in government funded primary schools to provide information leading to the design of better architectural solutions with

additional spaces for teaching, learning and playing. Comparisons were made between different space allocation standards for school grounds, such as the *British Primary School Standard - A.J Metric* (Fairwater and Sliwa, 1972), *American Primary School Standard* (Neufert, 1980), *Malaysian Primary School Standard* (Wan, 2000; Martin, 2002) and the present Australian or Tasmanian Primary school standard space allocation, *Commonwealth Standard - Australian Primary School* (Bower, 2003),

The model developed as a result of the above considerations provides more teaching and learning spaces at a lower cost, incorporates a greater variety of spaces for teaching, learning and play, and utilises the outdoor environment as a resource. The model incorporates flexibility of floor plan, variety of structural form and innovative landscaping forms, adapted to different school sites of the same size, which provide a greater space allocation per student. Total building area for students is larger than at present, at 3.75 square metres and the individual study area per classroom is 2.5 square metres. Other functional building space provisions include car parks for staff, ample nature reserves; built, open sports facilities and outdoor informal areas (refer to Tables 5.13 and 5.14). The spaces allocated for public use, the Library, Resource Centre, Physical Education areas, Administration Amenities for staff, Maintenance areas and toilets or washrooms, have been slightly decreased in size in order to provide more outdoor classroom space (as shown in Tables 5.13 and 5.14).

Potential for user control of the environmental conditions

The pavilion-type, open layout of the proposed school model with its surrounding shaded landscape could offer better opportunities for user control than the standard school. The open structures could be equipped inexpensively with retractable bamboo blinds and screens. The direct connections of the classrooms to the outside would allow some classes to be held fully in the open space when it is considered advantageous. The aim of the proposed model is, however, to provide generally improved climatic conditions compared to fully enclosed classrooms by allowing the natural, outside climate to provide variations within the human comfort zone to the open interior of the classrooms.

Table 5.13: General comparison of school grounds

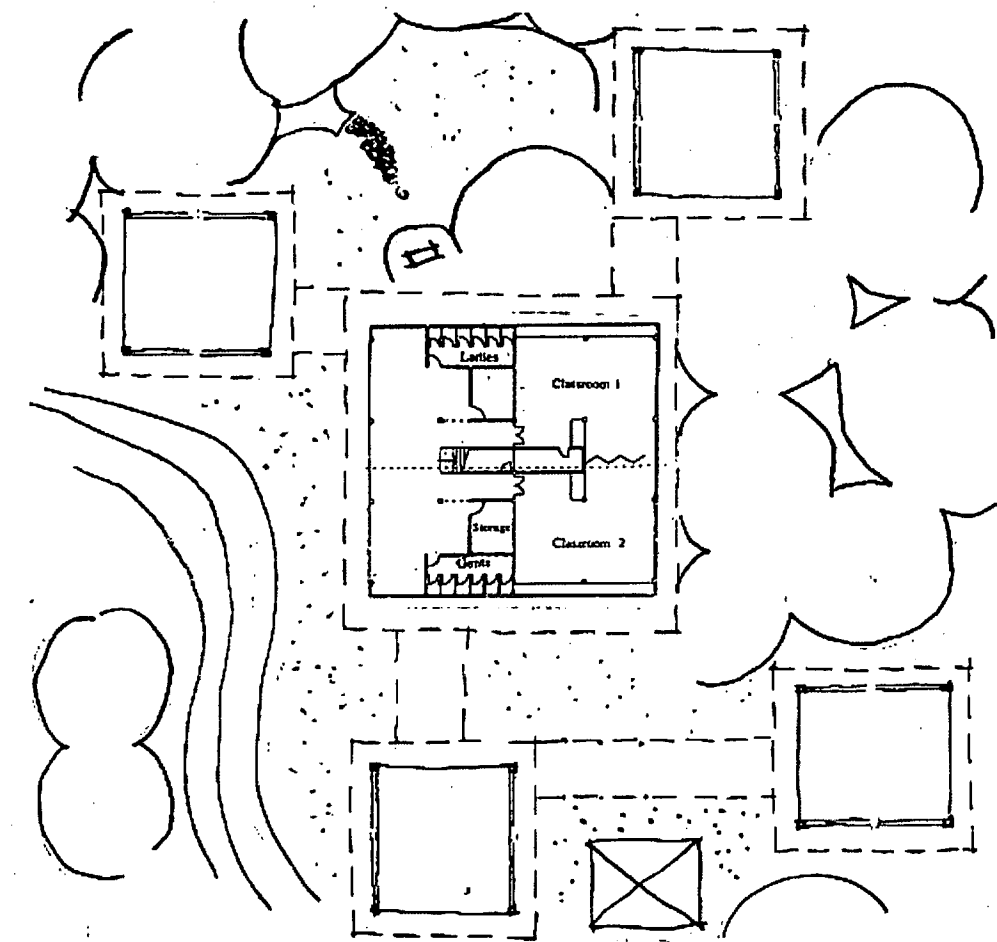
	<i>A.J Metric Standard British (Fairwater and Sliwa, 1972)</i>	<i>Western /American general Standard American (Neufert, 1980)</i>	<i>*Malaysia School grounds standard (Wan, 2000)</i>	<i>Australian /Tasmanian/ Commonwealth Standard (Bower, 2003)</i>	Proposal
Plan standardisation	Not available	Yes	Yes	Basic	Yes
	-ditto-	Yes	Yes	No	Varies
Form	-ditto-	No	No	Yes	Varies
Character	-ditto-	Minimal	Rigid	Natural	Varies
Landscaping	Minimal	Varies	Costly	Varies	Varies
Costing	Indoor orientation	Minimal	Minimal	More	More
Outdoor playing, teaching and learning spaces	Indoor orientation	Indoor orientation	Indoor orientation	Mix of indoor and outdoor	More
Teaching and learning spaces	No	Indoor	Indoor	Indoor and Outdoor	Indoor and Outdoor
Curriculum orientation	Yes	Nil	Yes	No	No
Exam orientation	Yes	Yes	No	Yes	Yes
Student orientation	1.54 hectare	No	Yes	No	No
Teacher Orientation	3.1 square metres	Not available	2.1 hectare	4.4 hectare	Minimum 2.1 hectare
Average total site size for schools with 1200 students	1.86 square metres – 3.21 square metres depending on years	3.56 square metres (rural) 4.67 square metres (urban)	4.42 square metres	6.13 square metres	3.75 square metres
Total building area per student	1.24 square metres	2.55 square metres (rural) 3.4 square metres (urban)	2.4 square metres	3.60 square metres	2.5 square metres
Individual study space in classrooms					

*Based on Ministry of Education, Malaysian Primary School Development Division (Aziz and Zaidi, 2003)

Table 5.14: General comparison of school grounds on functional spaces

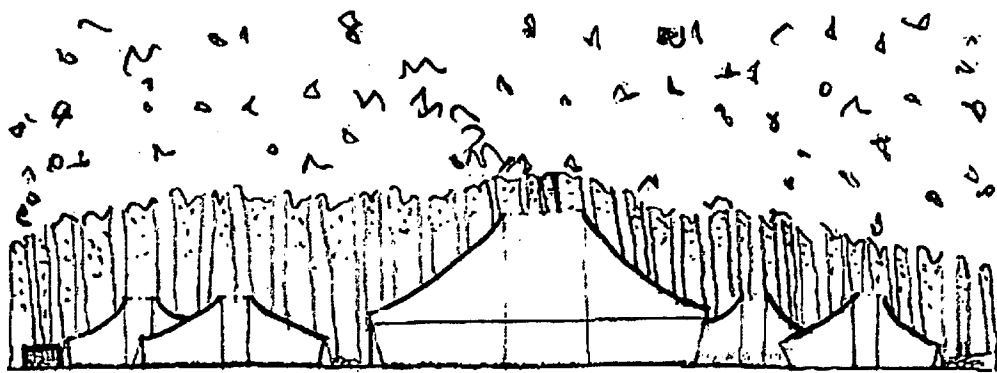
	<i>A.J Metric Standard British (Fairwater and Sliwa, 1972).</i>	<i>Western /American general Standard American (Neufert, 1980)</i>	<i>*Malaysia School grounds standard (Wan, 2000)</i>	<i>Australian /Tasmanian/ Commonwealth Standard (Bower, 2003)</i>	Proposal
Other functional building space	Not available	0.53 square metres – 1.01 square metres	2.02 square metres	2.53 square metres	1.25 square metres
Parking	-ditto-	Not available	1 teacher to 1 bay	Parking for all staff, visitors and bus loading / unloading	1 teacher to 1 bay
Open Sports Facilities	-ditto-	-ditto-	Badminton Court Netball court Playground or green acre	oval 2 basketball courts 2 playgrounds	1 basket ball, 2 badminton courts, 2 netball courts
Outdoor informal areas		-ditto-	Covered multi-purpose hall and Uncovered Tarmac	10% of total site estimated	grassed and landscaped area

***Based on Ministry of Education, Malaysian Primary School Development Division (Aziz and Zaidi, 2003).**



Plan

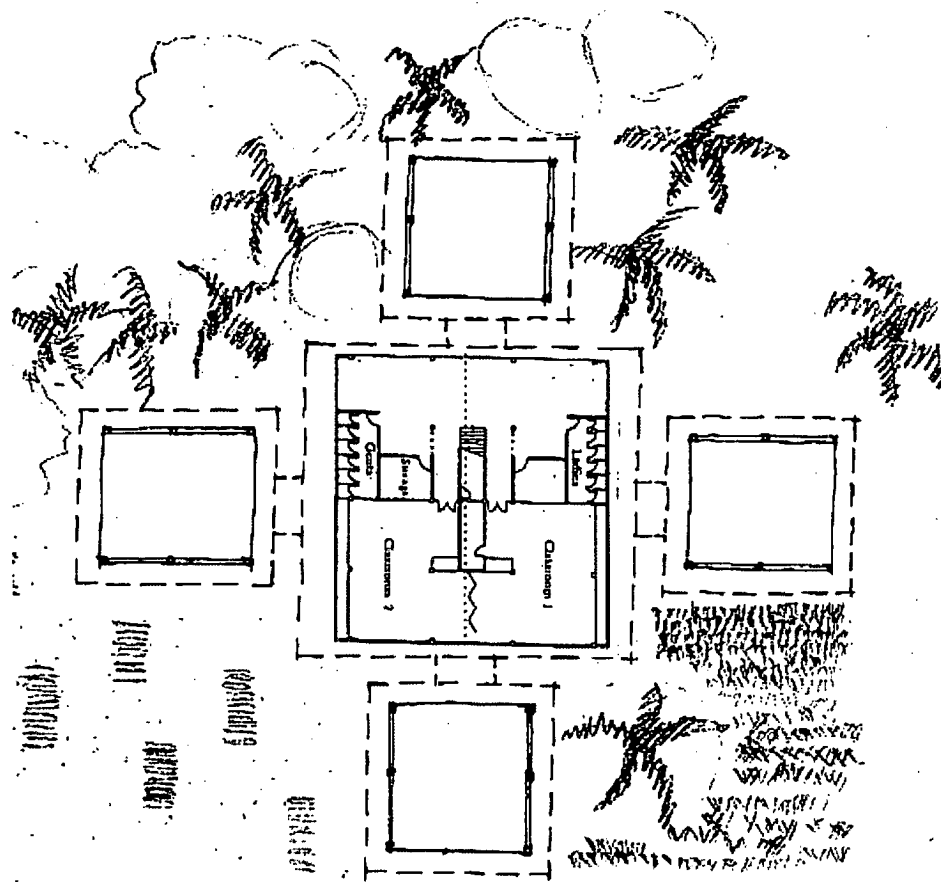
Scale 1:500



Front Elevation

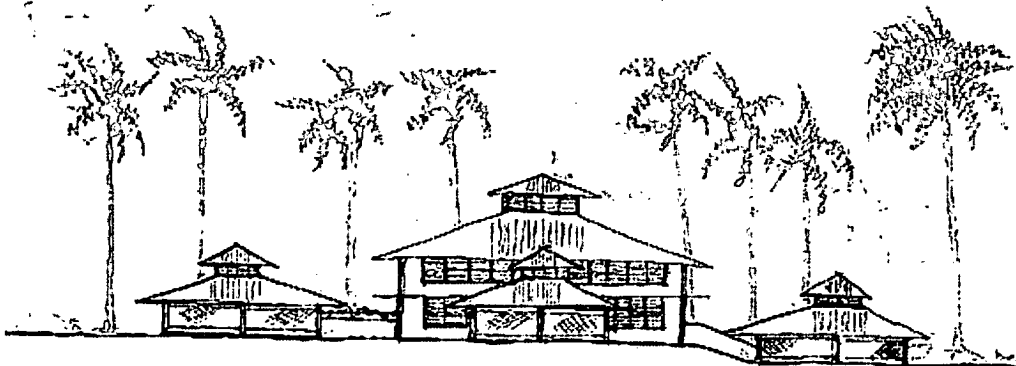
Scale 1:50

Figure 5.3: Study Model for outdoor classroom type 1 (refer to Appendix D)



Plan

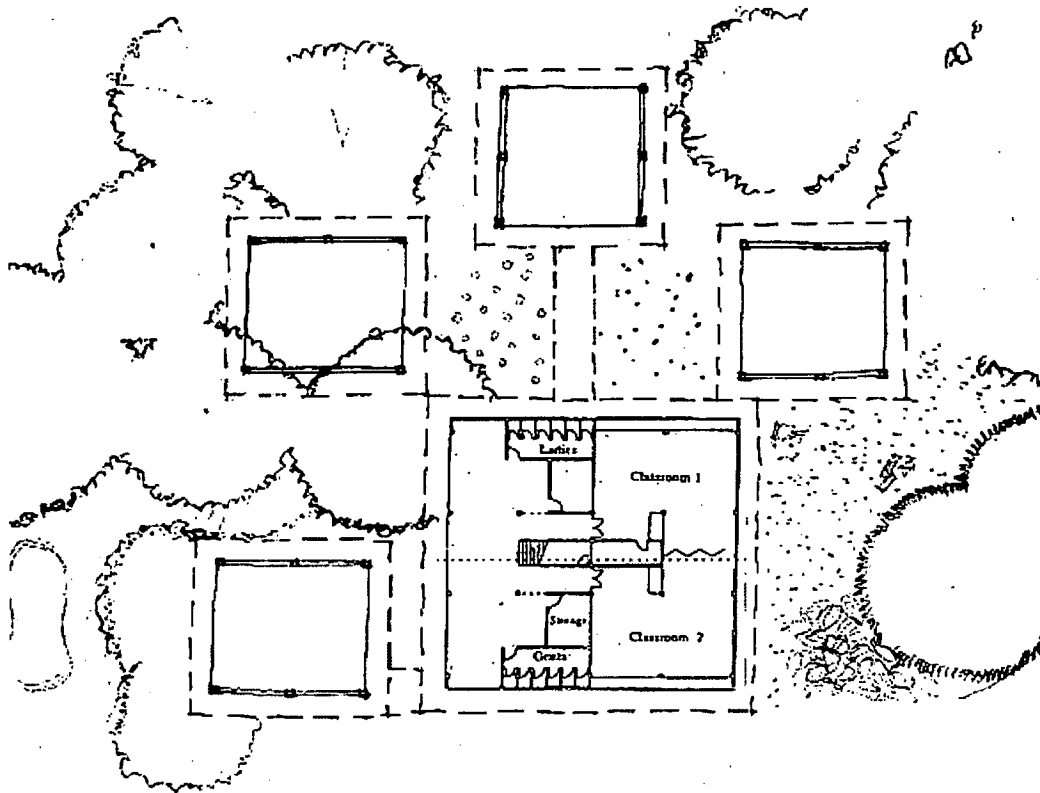
Scale 1:500



Front Elevation

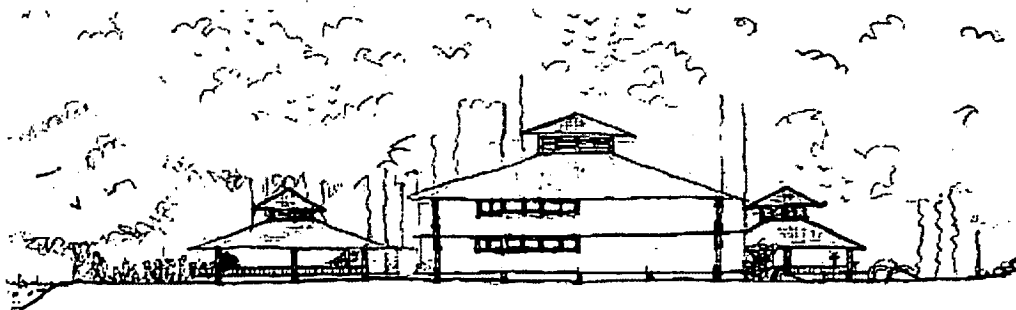
Scale 1:500

Figure 5.4: Study Model for outdoor classroom type 16 (refer to Appendix D)



Plan

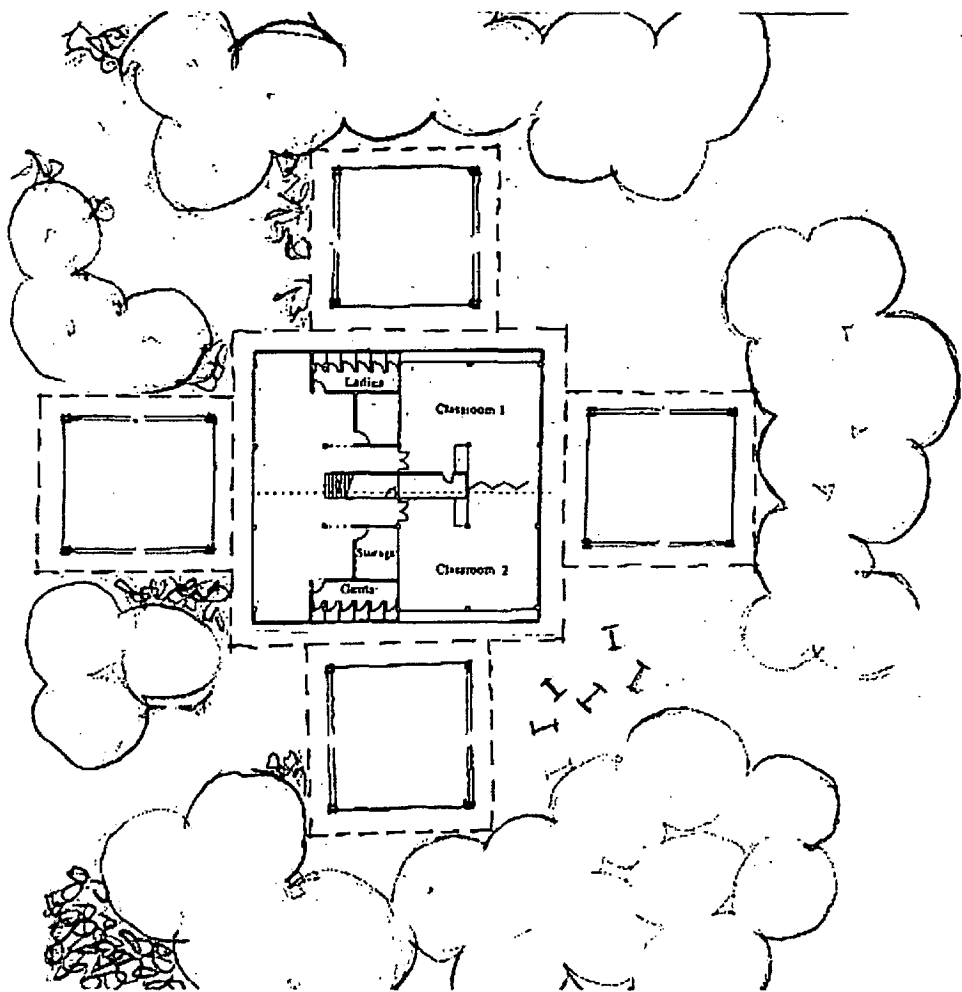
Scale 1:500



Front Elevation

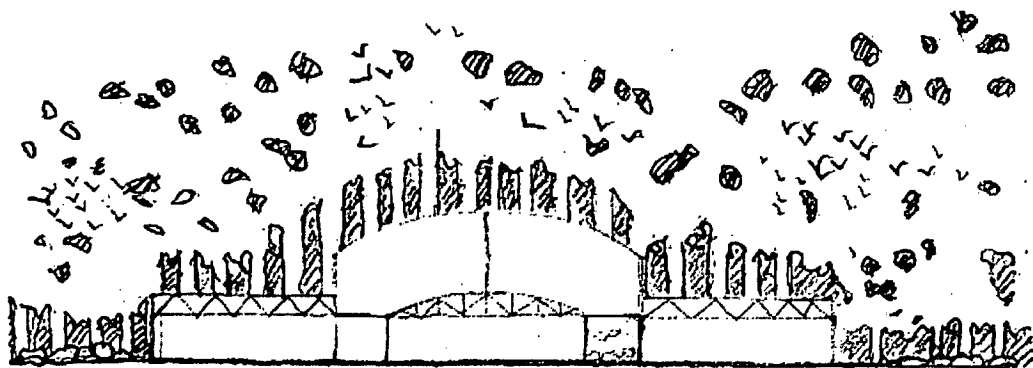
Scale 1:500

Figure 5.5: Study Model for outdoor classroom type 25 (refer to Appendix D)



Plan

Scale 1:500



Front Elevation

Scale 1:500

Figure 5.6: Study Model for outdoor classroom type 38 (refer to Appendix D)

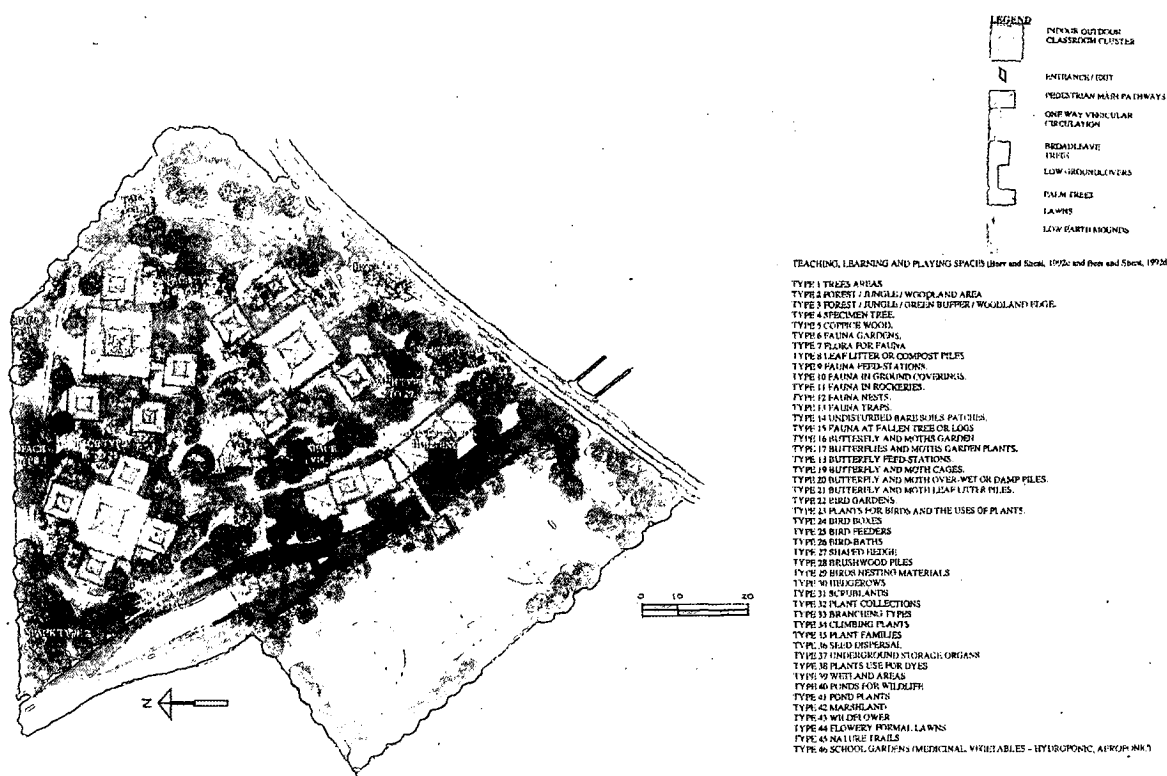


Figure 5.7: Formalised model

Formalised model based on feedback

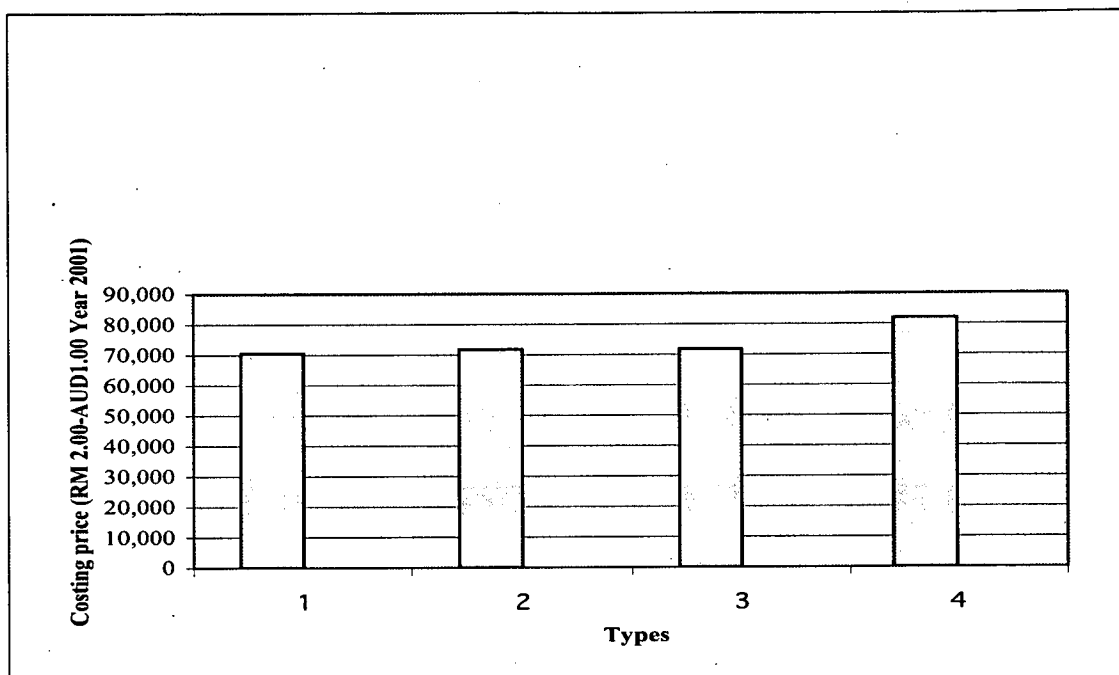
The site design model (refer to Figure 5.7, formalised model)

An existing educational site in Kuala Lumpur was used as a case design study, to ascertain the site's potential to develop a model design for a 1,200 pupil primary school based on open-air classroom models. The case study site is located in central Kuala Lumpur on a 4.04 hectare area. The case study design was developed as a pavilion-type school layout, with perimeter main circulation. The open-air modules were located on the site. Each comprised a central, two storeys high enclosed but naturally ventilated, classroom and amenities building, surrounded by four pavilions. Each module is designed to provide teaching and learning space for 400 pupils. The three modules, together with the central administration, library building and infrastructure occupy 3,610 square metres of the total site. This leaves 36,790 square metres of open space (Table 5.15).

Table 5.15: Site development area break down (refer also to Tables 5.13, 5.14 and Figure 5.7)

Total area of site	40,400 square metres
Total area of infrastructures including road and car park	3,600 square metres
Total building area (3 school building complexes, including, library and administration)	3,250 square metres
Total open space left for outdoor education and classrooms	33,550 square metres

The site design model demonstrates that a school for 1,200 primary school pupils can be located on an average size Malaysian school site, using (50 percent) open-air but sheltered classrooms, with generous sporting and landscaped spaces and a circulation which functions effectively. It was expected, following the results of the literature review, that these prototype open-sided classroom units could achieve an average 2.5 Kelvin reduction in temperature, compared to the ambient temperature of the surrounding, unsheltered space. Careful design of the surrounding landscape and location of the buildings would allow good cross-site air movement, which could be expected to result in a slightly higher temperature reduction.

Table 5.16: Categories of open-air classroom models above RM 45,000 (refer to Appendix D)

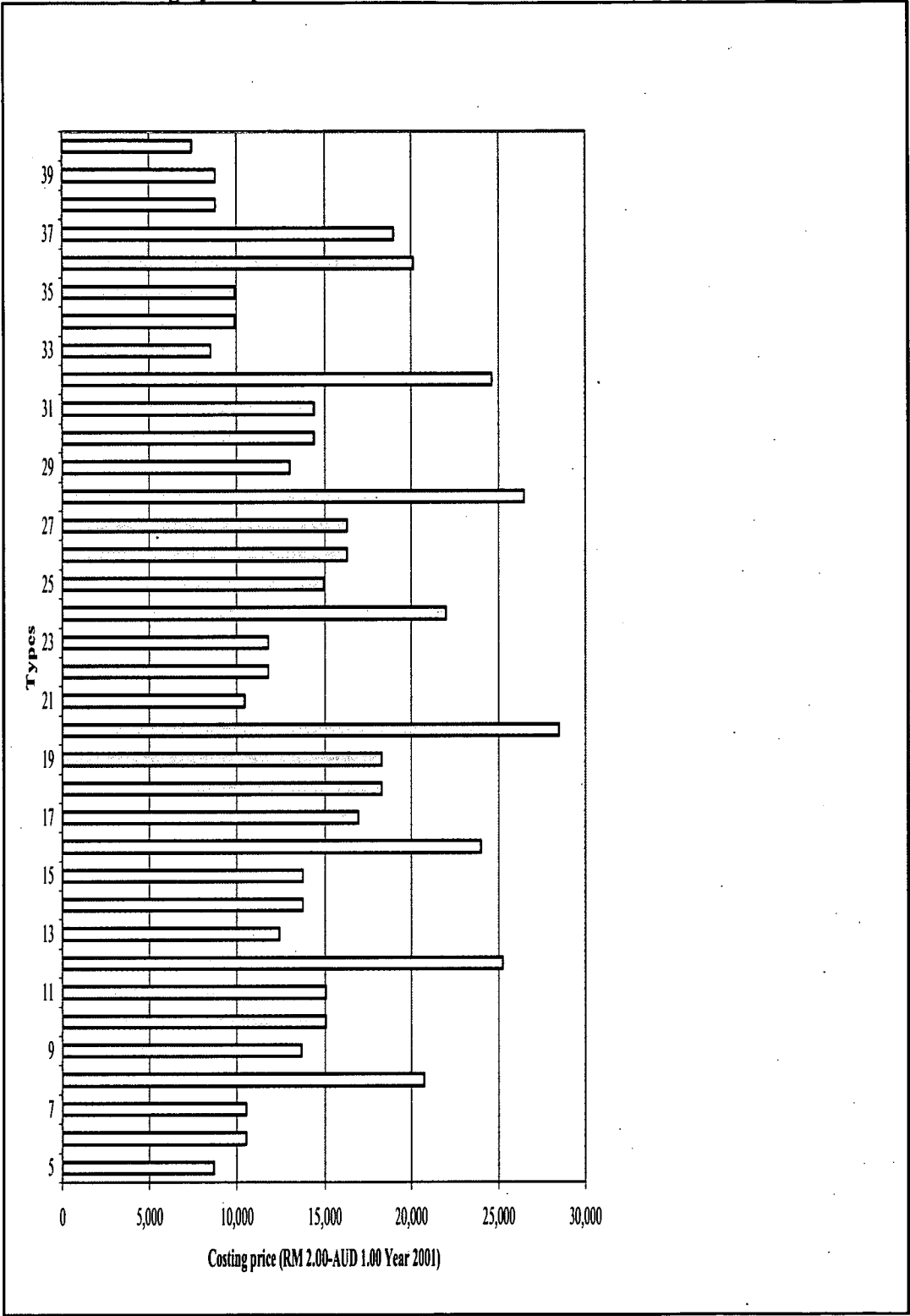
***Note:** Exchange rate based on 2001 average = AUD 1: RM 2.

**** Tables 5.16 and 5.17, RM 45,000 cost figures are derived from the current building costs of a standard Malaysian classroom (Wan, 2000).**

The above costing study is based on a design layout on one hypothetical site in Malaysia. The categories of open-air classroom models described in this table are based on different building materials and structures (roof and other supporting structures). Table 5.16 shows the costing of the four most expensive building types, listed in Appendix D.

In addition, Table 5.17 shows thirty six types of costing proposals for outdoor classrooms, using different building materials. These represent substantial cost savings compared to standard costing for government funded primary classrooms.

Table 5.17: Category of open-air classroom model less than RM 45, 000 (refer to Appendix D)



***Note:** Exchange rate based on 2001 average = AUD 1: RM 2.
**** Tables 5.16 and 5.17, RM 45,000 cost figures are derived from the current building costs of a standard Malaysian classroom (Wan, 2000).**

5.9 Investigative Issue 5: The perceived need for improvement of outdoor classrooms spaces.

The model was intended to:

- Improve perceived human comfort conditions for teachers and students during teaching and learning hours.
- Cater for the expansion of teaching and learning spaces in the future and give a sense of local identity to tropical hot and humid Malaysian architecture.

The survey questionnaire and interview were designed to ascertain the opinions of teachers from the three types of government funded primary schools who work in traditional spaces. The architectural model was developed and shown to the teachers and professionals, as mentioned, to gain their opinions about its suitability as a prototype for outdoor classrooms in government funded primary schools. The architect was in favour of innovation in government funded primary schools design, for the following reasons:

Generally, primary schools constructed in Malaysia by the government follow a standard design. This is mainly to facilitate the fast completion of schools to meet the fast growing population. It is believed that the spaces that we experience during our formative years will shape our characters. Primary school children in Malaysia spent more hours per day at school than at their homes. Since most of their time is spent in schools, the spaces experienced by the children should be varied and leave a lasting and memorable impression on them. At the moment the 'regimented' design of standard schools produces mundane and dull spaces, which do not stimulate a sense of place for children.

According to Table 5.10, (20 percent) of teachers' responses to the questionnaire indicate a developing awareness of the inadequacy of current educational spaces in primary schools.

The following views were expressed by teachers in response to the guided pictures in the questionnaire (refer to Appendix H) they were shown of outdoor teaching scenarios: "Students are not easily bored and teachers can conduct a lot of activities" (Year 4, female, rural school teacher, aged 20 to 30, with 2 months experience).

Teachers' comments were generally positive regarding the images they were shown: "Teaching and learning can be more effective and successful if students are allowed to go outside for certain teaching topics" (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience); "Students are not interested in school, especially the weaker students. However, with more outdoor opportunities, it will stimulate them to come to school" (Year 5, female, urban school teacher, aged 20 to 30, with 2 months experience); "Teaching will be more effective, due to the opportunities offered by the outdoor environment, with opportunities to apply innovative teaching strategies and techniques" (Year 1, male, urban school teacher, aged 20 to 30, with 2 years experience); "To continue to cultivate students' interest, outdoor teaching and learning should be practiced to improve education quality, especially for subjects such as Science and Life Studies" (Year 5, male, urban school teacher, aged 20 to 30, with 3 years experience).

Some responses were more specific and reference to other subject areas (such as Physical Education) was identified as an obvious choice for outdoor education. Other less obvious subjects were also mentioned, such as religious education:

The most important thing for subjects such as religious studies is to plan a design for classrooms, which allows proper teaching to be conducted. Currently, most primary schools have their own prayer room (*surau*), usually a contribution from the community. It is hoped in future during planning for new primary school buildings, there will be funding allocated for a separate *surau*, so that this subject can be conducted smoothly to achieve the desired teaching and learning objectives. Students can concentrate and understand subjects better with the help of teaching and learning aids and purpose-built spaces, especially in subjects such as religious education (An education officer).

A Year 1, female, urban school teacher, aged 20 to 30, with 4 years experience, stated: "Outdoor education is conducive to learning English in a more creative way, using trees and plants as sources of inspiration." This participant also believed that mathematics was suitable for outdoors teaching: "In early years it is related to actual objects, in basic operational areas. There are plenty of countable objects outdoors."

Many statements by teachers suggested that informal teaching and learning could usefully occur in outdoor spaces. For example, a participant stated: "An informal

study process could be environmentally related, for example the teachings of the Prophet could be related to nature so that the learning process can be informal but we still do not lose the teaching content”.

According to teachers, space is allocated according to ergonomic measurements of children's requirements, so the capacity to accommodate numbers of students in the future should be an important feature of new designs: “The design of current teaching and learning space allows for increasing student numbers. Their discipline and focus can be controlled. It is suitable for subjects requiring reading and a theoretical orientation” (Year 4, female, rural school teacher, aged 20 to 30, with 3 years experience).

Several teachers' statements show an early childhood focus, including: “The only changes needed are in the special classes for lower primary school level such as for children seven to nine years old, computer and science laboratories should be built separately” (An education officer); “The current teaching space is compact and crowded and there is not much space or opportunity to extend or to rebuild” (A quantity surveyor).

Several teachers also felt that student-directed learning opportunities would be maximised by more flexible classroom design, as indicated by the statement: “Generally school design should be more cheery, less formal and more suitable for kids in order to encourage activity among them” (A quantity surveyor).

One teacher gave her opinion about the suitability of various subjects for teaching outdoors as: “Teaching and learning can be more effective and successful if students are allowed to go outside for certain teaching topics” (Year 2, female, rural school teacher, aged 20 to 30, with 2 months experience).

Other statements concerning space and freedom for teaching and learning revealed teachers' views that the curriculum is unnecessarily restricted by the spaces allocated. It was suggested that more access to outdoor space could “Give students more opportunities to do outdoor activities, and give teachers more opportunity to provide suitable activities across the curriculum” (Year 1, female, urban school

teacher, aged 20 to 30, with 4 years experience); “It would be good and useful if current primary school design included more external spaces” (A landscape architect).

According to Tables 5.10 and 5.11, (80 percent) of teachers reiterated their dissatisfaction with the lack of teaching aids and the quality of teaching space. The importance of allocating more spaces for different subject areas and to housing various learning aids was stressed by respondents, as indicated in the following statements: “The teaching and learning area is limited. Furthermore teaching aids are too far away and it is a waste of time to get them” (Year 4, female, suburban school teacher, aged 31 to 40, with 9 years experience); “The current teaching and learning spaces are not equipped with classroom aids” (Year 2, female, suburban school teacher, aged 41 to 50, with 25 years experience); “A bigger classroom is needed, with more facilities for teaching and learning” (Year 5, female, suburban school teacher, aged 31 to 40, with 9 years experience); “Classrooms should be equipped with proper aids, to facilitate effective teaching and learning” (Year 2, female, suburban school teacher, aged 31 to 40, with 9 years experience).

The importance of better allocation of space was stressed by (20 percent) of teachers (refer to Tables 5.10 and 5.12). They indicated that more space should be allocated for students, particularly in view of increasing numbers, as indicated by the following comments: “More space is needed, so that students can absorb knowledge in a friendly and open environment” (Year 4, female, rural school teacher, aged 41 one to 50, with 18 years experience); “More students are going to school every year, more teachers and spaces are needed” (Year 5, female, suburban school teacher, aged 41 to 50, with 22 years experience); “There is a need for additional spaces for classrooms which outdoor classrooms would satisfy” (Year 5, female, urban school teacher, aged 20 to 30, with 3 years experience); “There should be more spaces, well-equipped with teaching aids” (Year 3, male, urban school teacher, aged 20 to 30, with 3 years experience).

The quality of teaching spaces was also stressed by a number of professionals: “Building design should be more friendly, airy and comfortable” (a landscape architect); “There is not much space for extensions or to rebuild” (an urban and

regional planner); “The ambience of the school environment should be upgraded” (a quantity surveyor); “Present day primary schools are ‘lacking in classroom space’” (a quantity surveyor).

Dissatisfaction with current classroom environments was expressed by most percentages of teachers surveyed. For example: “The dullness of the same square walled interior of the indoor classroom daily sometimes leads to teachers feeling ‘powerless’ because of the impact of the boring space” (Year 1, female, suburban school teacher, aged 20 to 30, with 8 years experience).

Overall, the idea that most subjects in primary school could be taught outdoors received a strong mean preference response, as shown in Table 5.3. The mean preference shown by participants for subjects to be taught outdoors was the majority, compared with a minority that did not agree.

The following comments show the range of participants’ opinions on this issue “The environment is hot and noisy at noon, causing students to be in the mood to study less after the break in the morning” (Year 2, suburban female school teacher, aged 31 to 40, with 9 years experience); “Indoor classrooms are good for students because they can focus clearly and there are not many distractions, except students can get bored easily, due to the same dull environment daily. This is due to variation in comfort in the teaching environment, for example after 11:00 am when it is no longer comfortable” (Year 1, male urban school teacher, aged 20 to 30, with 2 years experience).

In addition to the responses of teachers and professionals, the historical review of education and its development in Western countries suggests that education should be student-orientated and culturally relevant and appropriate. The writings of Rousseau, Dewey and Piaget confirm that cultural background and learning should be linked with children’s developmental stages rather than being imposed on all children regardless of age or stage of development (Thomas and Keats, 2000, p.89).

5.10 Conclusion

The results support the need to upgrade primary school architecture in Malaysia in order to accommodate modern pedagogical concerns and to improve perceived human comfort. Hence, the research question seeking to investigate the links between outdoor spaces and primary school based on education has provided the stakeholders with valuable insights regarding Malaysian education. The results of the research indicate professionals' support for the increased use of outdoor classrooms in government funded primary schools in Malaysia. The analysis of the prototype model on a hypothetical site indicates that it is possible to design outdoor classrooms, which are cost effective and able to meet present day requirements for teaching and learning spaces. The results of the qualitative research show that there are arguments for and against outdoors teaching, learning and playing spaces. There is evidence of a majority view in favour of increased use of outdoor classrooms. However, at present teaching occurs in indoor spaces, which is seen as a control mechanism, justified by the colonial pedagogical legacy. This is the dilemma in architecture and education that Malaysia faces as a post-colonial country.

The majority of building professionals, the education administrator and the teachers surveyed, strongly support an architectural and educational solution to the current problems of school design. The improvement of human comfort should also result from the provision of extra spaces for teaching, learning and playing in outdoor classrooms. The desire to develop a sense of local identity and an awareness of the importance of taking into account the particular regional qualities of the Malaysian environment is supported by the results of this study. It is significant to include this input in order to reduce differences arising from cultural upbringing. In the context of Malaysia's pluralist society and tropical environment there are many educational opportunities offered by the outdoor environment, from a number of cultural perspectives.

There are strong cultural, pedagogical and environmental imperatives underlying the desire for the provision of appropriate tropical architecture for primary schooling and education. As part of the improvements related to the above concerns, improving human comfort by passive design strategies is a viable alternative to the present

outdated design of schools as levels of comfort in teaching and learning spaces are inadequate at present, as hypothesised in Chapter 1. This indicates that there is a need to improve the standard Malaysian tropical hot and humid school environment by increasing the use of outdoor teaching and learning spaces. Introducing innovative pedagogy requiring a change of teaching methodology should be adopted in Malaysian primary schools, in line with recent Western changes in this area.

The results in this chapter are analysed and evaluated in Chapter 6.

CHAPTER 6: ANALYSIS AND EVALUATION

6.1 Introduction

In Chapter 5, a hypothetical model for a primary school design in Malaysia was proposed and tested against the research questions, the Investigative Issues and the Key Assessment Criteria.

In this chapter, the research findings are analysed in relation to the research questions and Investigative Issues. The Key Assessment Criteria identified in Chapter 5 (Results) are used as evidence for the arguments presented. Chapter 6 concludes by providing a working model, including the Key Assessment Criteria identified in the research.

Chapter 6 is presented as an analysis of the five Investigative Issues.

Investigative Issue 1 considered the ways in which government funded primary schools incorporate and use outdoor space. Following this, there is an analysis of responses to Investigative Issue 2: How stakeholder views reflect the current thinking in education.

Following are details of significant educational and architectural issues, providing a background to the context of primary school design in Malaysia, as stated in Investigative Issue 3: Issues relating to the development of an external classroom model.

This model was based on the data from the literature review, which outlines:

- The historical influences on Malaysian school education.
- Significant historical and modern examples of outdoor teaching and learning derived from Islamic and European educational history.
- The extant research into children's cognitive development and human geography, with particular reference to recent research trends in the study of children's thinking and their perception of natural places.

The Key Assessment Criteria (Chapter 4) are used to analyse the architectural viability of the hypothetical model. Investigative Issue 4 compares the climatic performance of the proposed model to the performance of current government funded primary schools. Such evaluation is based on the qualitative data collected by surveying the opinions of selected professionals involved in school building construction and management (refer to Appendix H, Questionnaire, Part 1, Section E, Question 2).

Finally, the discussion will interpret the stakeholders' responses and the findings of the literature review regarding the need for improving the present education spaces in Malaysian primary schools with reference to Investigative Issue 5: The perceived need for improvement of outdoor classrooms spaces. The Key Assessment Criteria in this section are based on the following architectural and ESD assessment criteria:

- Climatic performance;
- Economic performance;
- Building materials and structures;
- Future extension options;
- Landscape quality; and
- Potential user control of environmental conditions.

The discussion expresses the current needs of users in relation to outdoor education spaces, as perceived by teachers and building professionals.

Following this, a brief overview of the research results is given, indicating how outdoor space might best be incorporated to improve educational quality in Malaysian government primary schools.

6.2 Investigative Issue 1: The ways in which government funded primary schools incorporate and use outdoor space

The results in Chapter 5 show that there is little use of outdoor space by children in government funded primary schools, apart from traditional outdoor subjects such as Physical Education. At present, Physical Education is conducted outdoors only if the weather permits and not during hot or rainy weather. For subjects conducted outside,

the space is uninspiring and non-user-friendly, as it is surfaced with tarmac. The responses suggest that teachers currently give little thought to the opportunities offered by the surroundings. This appears to stem from conformity to the Malaysian educational policy (Lebar, 2000; Ramli, 2002), which allows for only minimal and detached environmental education.

According to most teachers and professional stakeholders surveyed, the existing standard school buildings and physical environment provides only a low level of human comfort for both pupils and teachers and also discourages direct interaction with the surrounding natural environment.

The outdoor spaces in rural schools are extensive, with ample teaching opportunities provided by the surroundings. Teachers justify their lack of outdoor teaching by indicating that they are not encouraged to carry out such activity. For example, a teacher commented: "The syllabus does not include outdoor activity" (Year 1, female, rural school teacher, aged 20 to 30, with 3 years experience). As rural teachers tend to be younger, less experienced and less qualified than suburban and urban teachers (refer to Table 5.2), such teachers may not feel confident about modifying the syllabus to include outdoor classes.

6.3 Investigative Issue 2: How stakeholders' views reflect current thinking in education

In this section teachers' awareness of recent changes in educational thinking will be discussed as it reflects upon their classrooms design requirements. Some teachers' comments acknowledge the tendency of students to become easily bored and uncomfortable in the current stuffy indoor classroom environment. As one teacher suggested: "To be in classrooms all the time can make students and teachers bored and cause teaching and learning to be dull" (Year 2, female, urban school teacher, age 20 to 30, with 4 years experience).

From the questionnaire and interview responses, the current practitioners' views show a disparity between the multi-cultural society perspective, Islamic values and the colonial tradition, which solidifies and maintains the scenario of control in

teaching and learning spaces in government funded primary schools in Malaysia. As shown in Table 5.6, a 'controlling' approach is suited to an 'exam orientated' and 'boring' teaching environment. The similarities in the language used in the questionnaire responses shows that Malaysian teachers are very conservative and regimented in their thinking, as indicated by their 'familiar' language and specific behavioural responses (Russell and Mehrabian, 1978; Russell and Pratt, 1980; Russell, Ward and Pratt, 1981).

However, as Table 5.3 shows, this study indicates that there was a strong gender difference in views about the value of incorporating outdoor teaching space. In fact, the views of male teachers who taught upper primary classes in the three schools surveyed did not correlate with the preference for outdoor or indoor teaching space shown by female teachers. Male teachers regarded outdoor teaching as more suitable for upper years. As male teachers in government funded primary schools tend to be considerably older and more experienced than female teachers, it is possible that their views reflect a more conservative and controlling view of pedagogy. Female teachers, who tend to have been educated in more recent times, tended to be more supportive of pedagogical innovation.

The notion of 'control' seems to be the most popular keyword appearing in the responses of teachers and the professional practitioners surveyed (50 percent), to describe the current quality of teaching and learning space at present in government funded primary schools in Malaysia. Hence, government funded primary school teachers' views did not generally reflect current educational thinking elsewhere. Most Malaysian teachers' view education as the transferring of a body of knowledge from teachers to students, a process which can only occur between the walls of a classroom.

However, the majority of participants (refer to Table 5.4) were attracted to outdoor teaching for subjects such as life skills and more exploratory and active subjects such as physical education. Others felt that outdoors education could be used to develop a deep understanding of our relationship to nature, for example in religious education subjects. Other than the three subjects mentioned above, outdoor space was identified by the majority of teachers (refer to Table 5.3) as suitable for the purpose

of teaching languages, for example, compulsory language subjects and other local mother tongue languages. Some other activities approved of by respondents for teaching in outdoor spaces included spelling on a nature trail, or essay writing about the natural environment, geography and history.

In the area of science, interaction with nature was seen to have learning benefits. In mathematics, most of the teachers felt that basic operational activities could be more concretely demonstrated in a naturalistic setting, leading to more satisfactory learning outcomes. In arts, drama and music, outdoor spaces were mainly seen as suitable for outdoor performance. Art teachers thought that art materials could also be obtained from the outdoor environment. These results show considerable awareness by some teachers of the potential of outdoor classrooms to prevent boredom and create a stimulating environment for children.

There were, however, comparatively few teachers who believed that a significant broadening of learning opportunities is presented by the outdoor classroom (refer to Appendix A and Table 5.3). In fact, it is widely considered by government funded primary teachers that students can learn about nature by watching television, rather than experiencing the environment directly. This seems to reflect their own lack of connection with the natural environment. This data fits with the findings of Kong (2000) that nature is seen as threatening and a source of danger by many highly urbanised Asian children. However, Kong's research also showed that many parents understand the learning benefits of direct contact with nature (refer to Chapter 3, Part B).

In view of the current lack of opportunity for using existing outdoor spaces in government funded primary schools, many teachers felt that there is a good case for incorporating external classroom space in the Malaysian education system. The strong positive response of most participants to the idea of outdoor teaching is a good indicator that increasingly, teachers are developing an awareness of the major impact of place on the thinking and behaviour of adolescents, as argued by Robertson (1993).

It appears from the questionnaire and survey data, that the majority of teachers agree that in general, government funded primary schools would benefit from a more student-centred teaching style, involving more freedom to choose activities and a mixture of playing and learning, in a variety of environments. Creating more dynamic, stimulating, spontaneous and culturally aware teaching and learning, in a variety of classroom environments, avoiding a controlling, exam orientated and boring approach, could achieve this. These findings fit with the extant literature on children's cognitive development and the historical review of developments in pedagogy.

6.4 Investigative Issue 3: Issues relating to the development of an external classroom model.

This model is based on the data from the literature review, detailing:

- The historical influences on Malaysian school education.
- Significant historical and recent examples of outdoor teaching and learning both in Islamic and European educational history.
- The extant research into children's cognitive development and human geography.

Literature review

The historical influences on Malaysian school education: In pre-colonial times, Malaysian education was influenced by educational ideas and architectural solutions other than those predominant in Britain and Europe (as discussed in Chapter 2). The British colonial period established new criteria for education in Malaysia, which still dominate. The British-based school design had little regard for human comfort for staff and students and was unresponsive to the local environment.

This problem has recently been exacerbated by wider access to education. Presently, the average number of students is forty per classroom, compared with only twenty students per classroom before Independence.

Significant historical examples of outdoor teaching and learning exist both in Islamic and European educational history. The extant literature concerning the development of the Western school contains numerous references to open-air education in the past; for example, by Diogenes (BC 341 to 270; cited in de Botton, 2004) and the Epicureans (BC 306 to 270). Although little physical evidence remains of pre-mediaeval schools, Greek and Roman classical writings mentioned schoolrooms where the didactic was a group of students reading, writing and learning classical oratory. Higher learning often followed the model of Plato's Academy (BC 387 to AD 529). Richardson (2000, p.364) notes that Plato's Academy involved master and pupil setting off on walks to discuss "plants and wildlife, mathematics and politics". It is believed that Plato also had a private garden (the Academy) in which he taught philosophy and in which students undertook scientific research.

Malay education was influenced by British models, which originally developed from monastic education. Education in the monasteries was ascetic and inward looking. Early Christian teaching gave little regard to the untamed natural world and to earthly life, as rewards were obtained in the 'afterlife' only (van Zuylen, 1995, p.38). Although gardens and scientific study were important elements of monastic education, earthly life and the physical world were considered a distraction from pious thinking and monastic life. The layout of monastic schools and buildings influenced later European school design, where spaces for teaching and learning were teacher-orientated and did not take into account the developmental needs of young students. Students sat stationary in rows and were expected to give the teacher their full attention. The focus was on controlling students, both physically and mentally, while the teacher was the only person who could move freely.

This model was established in government-funded primary schools and persisted after Independence. However, there are local precedents for more flexible seating arrangements, for example: an alternative traditional group seating arrangement or '*halaqah*' (circle) which is implemented in the local *madrasa* '*pondok*' or '*pesantren*' system in Indonesia (refer to Tok Kenali and the *madrasa* system discussed in Chapter 3, Part B and to Appendix B, Figure B1). The evidence from the literature review suggests that if classes were conducted outdoors, following this

type of model and the monastic garden model, it could lead to new approaches in classroom and landscape design.

There are some examples of recent primary school designs for hot, humid climates. In developing, highly populated, tropical and hot climate locations such as central Africa, Indonesia and Pakistan, outdoor classrooms are often used for economic reasons. Recently a contemporary regionalist approach to architecture in Australia has led to the design of culturally and climatically appropriate schools for indigenous people in the hot northern areas of Australia, such as those designed by Troppo Architects in the Northern Territory (Fantin, 2002). These schools have been built using a simple form of a small shelter structure, rather than the typical large school buildings found in towns and cities. They are an example of a successful school type within economic constraints and were compared with Malaysian schools in the literature review.

There are also recent working examples of sheltered but open-air schools in rural environments, such as those built by the Pakistani Department of Education in rural areas (Siddique, 1977). The Pakistani experiment reported that the quality of teaching and learning in the open-air schools is comparable to traditional classrooms.

Siddique (1977), in a study for the Pakistan Ministry of Education, demonstrated that students prefer to be outside during teaching and learning periods, and that teaching and learning can be performed outdoors in the minimal shelter provided by simple school buildings. Furthermore, their research shows that quality of education is not related to a complex built environment and that different types of minimal shelter, rather than requiring a massive building can provide for human comfort levels.

It is apparent from the results data from this study and from the studies referred to in the literature review, that more flexible use of space could be incorporated into an improved primary school curriculum, to expand educational opportunities which at present exist only at a minimal level in the government funded primary school environment in Malaysia.

Background to current thinking in education

There is some evidence of a tradition of open-air teaching in both classical European society and in historical Islamic Koranic schools. There have also been more recent teaching experiments by Neill (1971), Makarenko (1976) and Steiner (1976), where open-air work and the natural, or culturally modified, natural environment formed an important part of the teaching and learning philosophy and practice.

In Classical Greek and Roman society, originally teaching and learning was performed in outdoor classrooms; for example, by the Epicureans, Diogenes, in the Agora, in Plato's Academy and according to early Biblical and Islamic teaching. In modern times, an outdoor focus has been applied to education in specialised schools such as Summer Hill School by Neill (1971) in England and a school in Siberia (Makarenko, 1976), with outdoor teaching (gardening) being incorporated as part of the curriculum. Steiner schools all over the world have been designed to develop the child's relationship with the natural environment (school in a forest) but teaching still mainly occur indoors. Montessori schools, which focus on children's cognitive development, teach primarily indoors, although outdoor activities such as water play are a key focus of the curriculum. However, in South East Asia, only the Thai education system (Onec, 1999) includes outdoor study in the curriculum (refer to Appendix H, Questionnaire, Section D).

The case for strengthening the connection between teaching spaces and the outdoor environment

An important finding of this research is that in the three schools surveyed, some teachers are more critically aware of the environmental conditions of their indoor classrooms, the layout and flow of traffic and pedestrian patterns, the lighting and acoustic ambience of their classroom spaces, than their peers. Many researchers have considered the impact of place upon learning. Robertson (1993) argues that "place is the product of the dynamic interplay of phenomena and is a major influence on the thinking and behaviour of adolescents". Furthermore, Kassim's work explores the idea that the physical design of a building can influence the occupant's actions (Keumala, 1992). This view suggests that it would be appropriate to explore a school classroom and classroom cluster prototype, which could influence the attitudes and

actions of both the pupils and teachers by increasing their exposure to the natural environment.

The connection between learning spaces and the educational experience

As Le Febvre (1991, p.288) points out, spaces have great significance to their occupants, as spatial practice simultaneously defines place:

The relationship of local and global, the representation of that relationship, actions and signs, the trivialised spaces of everyday life and in opposition to these last, spaces are made special by symbolic means as desirable or undesirable, benevolent or malevolent, sanctioned or forbidden to particular groups.

It follows that different spatial settings for human activities produce different emotional responses, which can be part of a positive learning process. Types of knowledge can be offered through and from nature as a result of transactions between individuals and their physical settings (Gifford, 1997). During these transactions, individuals change the environment and their responses vary according to each environment they have experienced before (Gifford, 1997, p.1). Additionally, this type of transaction may well be the first time that some children enjoy school and look forward to participating. Where a second chance to be an achiever occurs, the place will be favourably attached in their memory because this place will give them a sense of belonging, rather than a feeling of being unwanted, due to their inability to excel in conventional classes. In addition, the feeling of belonging will build up their confidence, which later may lead to the development of a strong sense of personal identity.

Adams (1990) supports this view, asserting that the better the classroom ambience and the quality of the landscape, the more it will be used and enjoyed, thus enhancing the quality of the educational experience (p.11). She gathered information from interviews with parents and children by informal observation. Many teachers acknowledged the importance of attractive space outdoors and the contribution of outdoor learning to students' development (refer to Table 5.4). Many younger teachers are interested in student-centred teaching and understand, to some degree at least, the importance of spatial interaction in the cognitive development of young children. For example, they expressed their optimism and approval of outdoor

classroom spaces (refer to Table 5.12), compared to the older teachers, who are used to the previous controlling and teacher-centred pedagogy.

The extant research into children's cognitive development and human geography: The opinions of human geographers, such as Kong (2000), support Robertson's (1993) research on the significance of children's interaction with outdoor space. Children are highly aware of lawns and floor surfaces; delighting in foliage, woods and greenery (Manan, 1998). Humans have a strong and pleasant memory of hills and water in the landscape. In addition, they are consciously alert to spatial qualities and have a definite preference for openness and spaciousness and distaste for crowdedness. Moreover, some children do not excel in indoor classes (Beer and Sheat, 1992a; 1992b), and opportunities to study outdoors may give a better understanding of abstract concepts in relation to the environment. The literature in the field of human geography, as explained in Chapter 3, suggests that space and place are significant elements in a child's cognitive and social development. The environment in which a child interacts and relates to peers and adults who occupy the same space is a crucial element in mastering physical and social skills.

According to Adams (1990), the cost of excursions off school grounds justifies the provision of stimulating playscapes in school grounds. For example, primary school children in England usually have opportunities for field trips towards the end of term. The cost and other problems associated with taking children on field trips outside the school, to parks and natural areas as part of the school curriculum, may increasingly oblige schools to look to their school grounds as a cheaper and more readily accessible teaching resource. This consideration would be relevant to children living in highly urbanised areas providing little contact with nature, such as Kuala Lumpur.

In addition to recent research, trends were the study of children's thinking and their perception of natural places. Robertson (1993) investigated the influence of place on the thinking and behaviour of adolescents, concentrating on the effects that natural settings have on cognitive development and on people-place interactions. Her findings were that the nature of both the social and the physical environment promotes cognitive sets that will facilitate responses in related tasks. There is some evidence in her research that the natural or naturalistic (rural) environment has a

positive effect on the behaviour and learning or thinking ability of adolescents. Her work is very much in line with the findings of other educational and environmental psychologists such as Kaplan (1987), Silbereisen and Noack (1988) and Zube (1990), regarding people's preferences and aesthetic appreciation of place. Some earlier educational theorists including Neill (1971) and Steiner (1976) also recognised the effect of the natural or naturalistic environment on school age children's behaviour and learning ability in England. Makarenko (1976), the highly regarded Russian educator, recognises the importance of the farm environment as a significant factor in his successful re-establishment of socially displaced students in society.

Current Western educational thinking is firmly in favour of incorporating outdoor space into the primary school curriculum. This is further discussed in relation to Investigative Issue 3 previously.

There appear to be three primary variables in the extant literature, which relate to architecture and additional variables that relate to education issues in school design.

6.5 Investigative Issues 1, 2 and 3: Synthesis and findings

Architectural form and aesthetic quality of school buildings in the regional/traditional Malay context: The styles of both traditional Javanese and Malay buildings are identified by the shapes of their roofs, indicating building uses according to functional and spiritual hierarchies (Wikantari, 1994). Malaysian architecture has also been influenced by Hindu, Islamic, Chinese, Portuguese, Dutch and English cultures. In addition, the evolution of form and aesthetic quality of buildings and materials has been based predominantly on three factors:

- Locally available building materials;
- Local builders' knowledge of construction and materials; and
- Cultural *a priori*.

Atmadi (1987, p.86) established a number of important criteria for traditional Javanese buildings. Their findings are also valid for Malay buildings because of the similar construction, climate and historic tradition. Their criteria are as follows:

- Comfort, privacy and security controlled by means of roof shapes, walls, openings and internal courts;
- Tropical climate and humidity controlled by means of roof shapes, walls, openings and raised floors;
- Aspects of way of life, symbolic system and social structure expressed in hierarchy of spaces and building elements, separation of sacred and profane spaces and quality of interior lighting; and
- Anticipation of unpredictable situation such as infertile land, flood and earthquake, by means of movable knockdown and semi-permanent wood construction methods.

The extant research into regional architecture and its suitability for local climates in South East Asia suggests that Malay-Javanese traditional building types offer reasonable thermal comfort solutions in hot tropical climates. When compared with the current European style school buildings, (which require air conditioning to achieve human comfort), they perform better.

In terms of indoor and outdoor spatial interaction, in traditional Malay buildings and landscape, Mohyuddin and Yusof (2002, p.501) published pioneering research into the characteristics of traditional Malay palaces and the traditional Malay landscape. Although their research is based on the analysis of two palaces (Istana Belai Besar in Kota Bharu and Istana Seri Menanti in Seri Menanti), their findings are relevant to this analysis as traditional Malay palaces can be considered as a more sophisticated development of the social and spatial organisation of ordinary Malay buildings and landscape.

Mohyuddin and Yusof (2002, pp.499-500) found that in traditional Malay buildings and palaces “much consideration on the sustainability of their natural site, and their built environment”. The traditional Malay society “respect [ed] and appreciate [d] nature and lived within nature, ...nature is a refuge, which has brought comfort and [a] resourceful living environment”. They describe traditional buildings as having three types of spaces:

- Private spaces (usually elevated), but with visual connections to outdoor views;

- Semi-private ground level spaces with visual and direct connections to landscaped space, usually to the sides of the buildings or to landscaped courtyards; and
- Public space on the front of the building, consisting of the open verandah (*anjung*) and the open, but tree-planted front courtyard.

Based on research by Mohyuddin and Yusof (2002), the following simple questions were used to evaluate existing school building types, compared with the proposed model:

- Do the classrooms have direct views to the surrounding landscape?
- Do the classrooms have direct connections to the surrounding landscape?

The proposed school model satisfies both criteria. However, as the existing standard Malaysian classroom, while allowing some restricted views through standard windows to the surroundings, does not allow any direct visuals from the classroom to the surrounding landscape.

Since the beginning of the *pondok* school system, which used simple building complexes for teaching Islamic knowledge, through to the new religious schools in Malaysia, Malaysia has struggled to develop a uniquely Malaysian education system. Such a system should ideally retain the academic and secular qualities of Western education, while also preserving the qualities of traditional Islamic education in an environmentally sensitive architectural form. The data from this study indicate that most respondents agree that school building types need to evolve to suit the unique Malaysian context, as many teachers' responses to the questionnaire indicate a developing awareness of the inadequacy of current educational spaces in primary schools. Building professionals also concur with this view (refer to Figures 6.1 to 6.3).

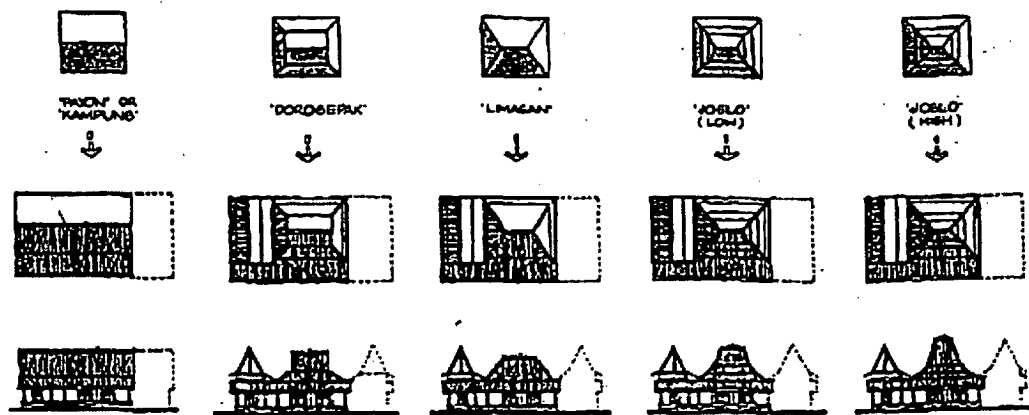


Figure 6.1: Traditional building diagrams plans and sections (Wikantari, 1994. p.69).

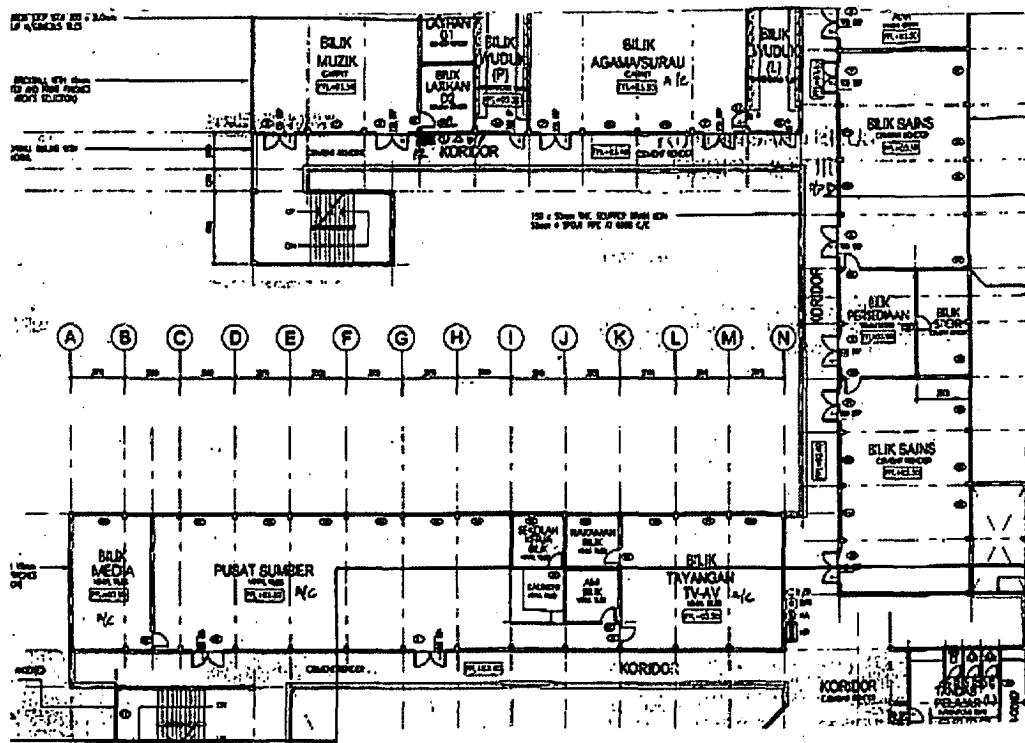


Figure 6.2: A current typical Malaysian primary schools (Wan, 2000)

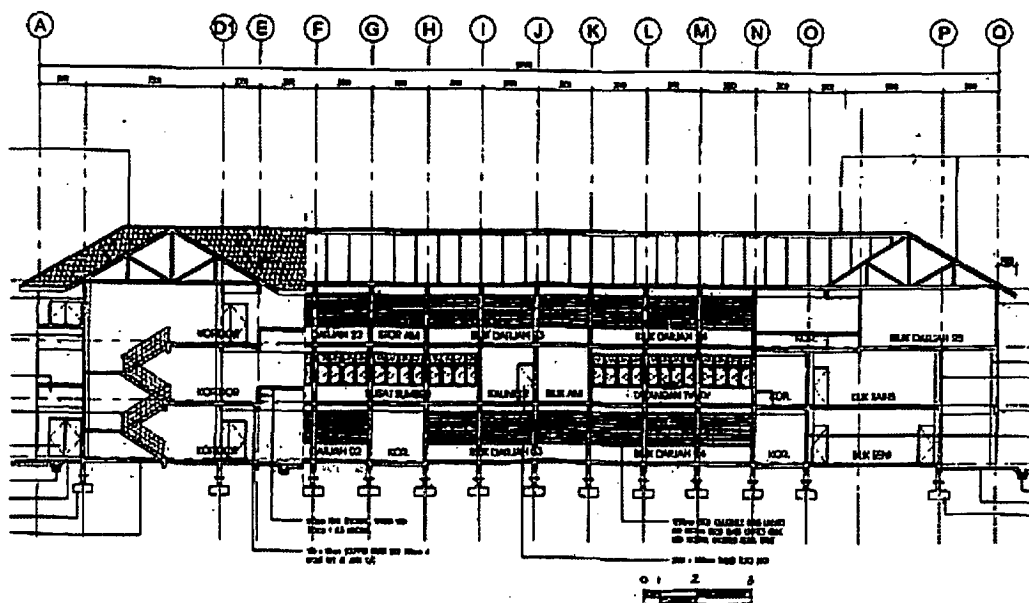


Figure 6.3: A current typical Malaysian primary schools section (Wan, 2000)

An examination of the above Figures 6.1 to 6.3 and plans show that the current standard school building has no relation either in architectural style or spatial organisation with traditional Malay buildings (refer to Figure 6.1) and they are clearly a derivative of British school buildings originally designed for a different culture and climate. By contrast to the current situation, Islamic tradition records that the Prophet Muhammad used to teach under a date palm surrounded by students. This space provided learning tools such as the sand on which he drew and the surrounding environment. This environment provided examples, which informed his teaching and engaged his students physically and mentally with the learning experience.

It is not suggested in this study that we return fully to the simple methods of teaching by the Prophet and his followers 1500 years ago. We can, however, learn from the ways early Koranic teachers retained the attention of their students and provided explanations for complex ideas from the immediate environment. The proposed school model, although not fully developed architecturally, is derived from traditional Malay buildings and attempts to provide a similar spatial, climatic and stylistic environment within the functional restrictions of a school.

Table 6.1: Comparison of architectural influences

Architectural influences	Current schools		Proposed School Model		Source of assessment
Architectural form and aesthetic quality of school buildings in the regional/traditional Malay context	Western influenced	*	Proposed school building type is based on a modernised form of traditional Malay buildings	**	Comparison of existing school plans and elevations with those of the proposed model.
Indoor and outdoor spatial interaction, in comparison to traditional Malay buildings and the landscape.	Little or no indoor-outdoor spatial connections	*	Strong and positive spatial connections	***	Examination of existing school plans and reference to literature (Wan, 2000).
Building for the Malaysian school context	Outdated Western pedagogical model	*	Potential for student centred learning/innovative pedagogy.	***	Responses from interview and questionnaire.

Key: * non existent, ** weak, *** strong

Key Assessment Criterion 2: Educational qualities (refer to Table 6.2), uses the following variables to examine the user-friendliness of teaching and learning spaces, with particular reference to:

- A sense of belonging, opportunities for free expression and thinking for character development; and
- Teaching, learning and play opportunities inherent in spatial design.

Educational qualities of Malaysian school buildings are assessed based on recent developments in pedagogy discussed below under Key Assessment Criterion 2.

It was noted by the urban and regional planner that:

The lack of a sense of belonging can produce negative social outcomes. The main social problems identified in primary schools are vandalism and graffiti. These crimes are considered petty and unpremeditated, the result of boredom and frustration. Crime Prevention Through Environmental Design (CPTED) as an approach, which promotes a holistic response to the problem. Planning and building for security, maintenance and community interaction can minimise negative social outcomes. Positive community interaction and activities during and after school hours could be an alternative for CPTED and create 'a sense of place' and a sense of community ownership of facilities.

According to the urban and regional planner:

In order to develop a good school design, Malaysian cultural norms should be the prime guide for preparing the design. Daytime security could be provided on the perimeter of the site by suitable fencing and outside interference could be minimised by visual perimeter buffer landscaping. However, community access could provide security after school hours, as bringing the community on site would expand the communities' sense of ownership of the space. More focussed security might be provided by means of lockable storage units within buildings or outside, to protect specific resources.

The proposed school model does not necessarily change the perceived need for control, but it may offer opportunities to develop better interaction between teachers and pupils by removing the constraining classroom walls and replacing them with a more interesting and stimulating landscape environment.

Teachers' responses to the idea of increased interaction with the natural environment within the school were linked to the evidence from the extant literature on cognitive development in the design process of the prototype model. The degree to which we have a positive attachment to a place will depend on the opportunities presented by that place to successfully exercise and master physical and social skills. With the incorporation of informal play into the curriculum, opportunities for playing and learning can occur concurrently. Erikson (1963) categorise spheres of Play and Environmental Competence into three categories: the autosphere, the microsphere and the macrosphere. By the time children enter primary school they have advanced to the macrosphere stage when, spaces are perceived as having both physical and social components.

In this macrosphere environment, a child's competence develops not only from feelings of mastery over the physical components of the space, but also involves mastery over the social ones. Generally, Malaysian teachers are not aware of these theories of cognitive development. However, many of them intuitively appreciate the benefits of outdoor activities for learning and social interaction. However, even in Western countries, whereas educational theory concerning play has influenced the design of school buildings and the practice of learning and teaching in the classroom, it has not had the same impact on the design or use of school grounds (Adams, 1990, p.35). Recent research suggests that informal learning in primary school grounds has

a significant part to play in the context of personal and social education. In Western primary schools, play is seen as an important aspect of the informal curriculum, where the playground has a special significance in promoting the child's physical, social, emotional, creative and intellectual development.

Primary teachers recognise the value of play and the need to provide for play activities, but many lack a theoretical understanding of play and are uncertain about how to provide for it in school grounds (Adams, 1990, p.71).

According to the landscape architect interviewed for this research, "many stakeholders recognise that opportunities for learning by interaction with nature should be explored more fully in primary schools. The main problem is that there is too much orientation towards indoor classrooms in Malaysian schools", as noted by the education officer interviewed: "Activities like playing and learning outdoors should be available for children because they learnt more when they are happy".

It was assumed at the outset of this research work that properly designed outdoor classrooms in an appropriate landscape setting could fulfil many of Malaysian children's developmental needs, provided that they are incorporated into a sympathetic pedagogy. According to the landscape architect, outdoor classrooms would constitute an ideal flexible learning environment:

Space should not be designed with any fixed furniture but should be close to storage facilities where furniture used in activities can be easily stored. The space must be designed so that many activities can be performed and many events can be held.

Manan (1998, p.61) suggests nine basic design elements were required in the school grounds to encourage learning and play. They are:

- Accessible and inaccessible;
- Active and passive;
- Challenge or risk and repetition or security;
- Hard and soft;
- Natural and built environment;
- Open and closed;

- Permanence and change;
- Private and public; and
- Simple and complex.

To date, these elements are not included in the design of government funded primary schools. However, they would be useful as a guideline when redesigning or upgrading school grounds in Malaysian primary schools and were considered in the design of the prototype classroom model.

According to Lebar (2000), it is difficult to understand why Malaysian society continues to invest so much in traditional teaching methods and traditional places for such learning. However, the way teaching, learning and play spaces are designed reflects the values on which each society is based and these tend to be reflected in pedagogical practices. It is evident that Malaysian schools in the 21st century will need to change their outdated, teacher-centred practices, in order to provide the best learning opportunities for their students.

Highly skilled teachers and well-designed space are both required for teaching and learning purposes. Although they do not contribute in a simple and additive way their contribution is accumulative. Furthermore, according to the architect interviewed for this research, unfortunately at present, few building professionals have the time, energy and resources to collaborate with educational specialists to translate the new ideas in education into effective spaces.

Although some reference to environmental education does exist in the higher institution educational courses in Malaysia, none can be found in Malaysian schools practices at the primary level (Singham, 2003).

In the following section an analysis of the research classroom design model developed in response to the stakeholders' comments is given from an architectural perspective.

Table 6.2: Comparison of the educational qualities

Educational qualities	Current schools		Proposed School Model		Source of assessment
User-friendliness of teaching and learning spaces with particular reference to:	Inflexible classroom system	**	Opportunities for more flexible and friendly spaces	**	Questionnaire and interview data
A sense of belonging, opportunities for free expression and thinking for character development and	Not offered	*	Provision of spaces to perform teaching, learning and play.	**	Questionnaire and interview data
Teaching, learning and playing opportunities inherent in spatial design.	Not offered	*	Provision on the school grounds	**	Questionnaire and interview data

Key: * non existent, ** weak, *** strong

Analysis of the proposed model

Part D presents an analysis of the architectural aspects of the proposed model compared to existing government funded school buildings in Malaysia, to suggest a viable and cost effective solution to the design and functional problems identified in the qualitative and quantitative data. The criteria analysed in this section represent the primary parameters for assessing the physical environment of a primary school. Stakeholder views about the proposed model are presented in relation to the following Key Assessment Criterion 3, which is discussed with particular reference to the potential for user control of environmental conditions, as follows:

- Climatic performance;
- Economic factors;
- Building materials and structure;
- Future extension options;
- Landscape quality; and
- Potential user control of environmental conditions.

These criteria are then related to performance, cost structure and materials and environmentally sustainable design issues.

6.6 Investigative Issue 4: A comparison of the climatic performance of the proposed model.

The model proposed is based on specific aspects of local culture and architecture, using particular types of structures in the research Study Model. The proposed model and the landscaped surroundings developed for the research will be tested against each of the Key Assessment Criteria, as described above.

Climatic performance (refer to Table 6.3)

In general, as shown in Table 5.3, many teachers and all building professionals expressed the view that the proposed model offered an environmentally sensitive solution to providing thermal comfort in hot humid climates. Most believe that the model demonstrates a preferable teaching space to the current, expensive, hot and stuffy buildings, which offer no interaction between outside and inside spaces.

Thermal neutral comfort in Malaysia ranges from 27° C and 27.8° C, using Nicol's formula (refer to Table 3.9). The PMV range for thermal neutral conditions is from -0.5 to 0.5. Generally, that the indoor climatic environment of standard, non air-conditioned schools in Kuala Lumpur and in most other parts of Malaysia, do not have a thermally comfortable environment from 11:00 am to approximately 5:00 pm for most of the year.

This research shows that many teachers are not comfortable in the standard classroom during the day and are of the opinion that human comfort is not adequately catered for in the current government funded primary school classroom.

Many teachers (refer to Table 5.3) felt that the proposed model could offer improved outcomes by providing cooling, shade and natural air movement (Wikantari, 1994; Yusof and Mohyuddin, 2002).

Wind speed in Malaysia is generally less than 1.5 m/s (Ramli, 2003), and therefore should not be regarded as problematic in terms of providing good learning environment.

It was expressed by many teachers that classrooms based on the model could improve concentration of both students and teachers. However, they also recognised that in Malaysia space is limited for conducting teaching and learning because of the large number of students. For example, forty five to fifty students per classroom is not unusual, especially on new government primary school sites, such as the suburban school sampled in this research. As one suburban schoolteacher pointed out “the classroom design does not allow any outdoor learning”.

The building professionals generally surveyed expressed the view that the model provided a better ESD approach than existing classrooms, with viable costing and maintenance requirements. For example, the mechanical engineer suggested that the building materials should be assessed in primary school buildings with reference to energy efficiency and durability.

The urban and regional planner considered that an environmentally sustainable approach, if adopted for building and upgrading existing buildings, would alleviate human comfort problems in primary schools, as well as minimising building costs. The cost saving thus produced could be allocated for landscaping the school grounds and contribute to crime prevention through an environmental design (CPTED) approach. An environmental impact assessment (EIA) and a social impact assessment (SIA) could be undertaken in order to reduce the impact of the school on its surroundings.

The landscape architect advised that opportunities for students to learn from the environment should be incorporated in the model design as another means of improvement of outdoor classroom teaching, learning and play. In addition, the structural engineer considered that the opportunity to learn by doing and understanding simple structures could be implemented to provide students with more direct involvement in teaching, learning and play.

According to the quantity surveyors, cost-efficiency could be achieved by using local and cheap building materials, which are structurally practical, environmentally sustainable and meet safety considerations.

Economic factors (refer to Appendix D for further details and Table 6.3)

The building of new schools is a major investment for any government; thus costs of new school buildings are subject to economic limitations. However, an over-emphasis on economy can result in fairly basic, utilitarian school buildings. Due to the high cost of the buildings, the landscape design and construction quality of the school grounds has often suffered, resulting in cheaply paved surfaces and token tree planting, which often fails to address ESD issues.

Recent construction costs of an existing standard Malaysian government primary school were referred to in this study (refer to Tables 5.16 to 5.17) and cost estimates were provided by a Malaysian quantity surveyor for the costing of the forty prototype structures developed for this study (refer to Appendix D).

Classroom construction costs were only used as indicative cost estimates. The comparison of other associated building costs, such as wet blocks, offices, library, communication space, were outside of the scope of this research. These factors could be considered in the full architectural design development of a pilot school model in future, for trial purposes.

According to the Malaysian Education Department, the cost for the average standard classroom of (9 metres x 7.5 metres) is around RM 45,000. This represents a figure of RM 666 per square metres including finishes, but excluding furniture and equipment.

The roofed, but otherwise open or semi-open classroom prototypes developed for this study are ten metres by ten metres in size. The quantity surveyor estimated costs to vary from RM 7, 450, using a barrel vault membrane and truss structure and gravel paving (type 40, refer to Appendix D) to RM 28, 500 using a timber structure, tile (clay or concrete) roof on timber trusses, timber lattice and timber decking (type 20, refer to Appendix D). The variation in costs is a result of the different quality and costs of the materials used (refer to Appendix D).

The above estimates represents building costs of RM 75 and RM 285 per square metres area. Table 5.17 shows the estimated percentage of savings in proposed classroom construction. The costing studies show using alternative types of building materials and simple structures and construction methods for outdoor classrooms could make savings. The landscape architect suggested it that: "The costs saved can be allocated to landscape the school grounds. A variety of local building materials can be used to create varied building types to suit different sites". He further stated that:

Ideal designs for school grounds should incorporate structures, planting and art works that pupils can design and construct or carry out. Student choice may be reflected for example in the types and sizes of plants and planting areas that are chosen and designed. It is possible to make a checklist of things children are capable of and to try to ensure that he design incorporates opportunities for children to design, build and plant.

Building materials and structures (refer to Appendix D for further details and Table 6.3)

Satwiko (2002, p.85) states that;

... in hot humid tropical regions, roofs are the most important building elements, since the sun is usually high. In a very extreme way, if we do not have any privacy and security problems inhabitants might prefer not to have walls in their buildings. Roofs are mainly to protect occupants from severe heat of the sun and torrential rains.

Traditional buildings, consisting only of a roof and an elevated timber platform, do indeed exist in many places in the tropical climatic belt, particularly in New Guinea.

Satwiko (2002) carried out research into the nature of suitable roof materials for the tropics. He found that the best roof in this climate is a reflective, bright white roof of smooth material. The temperature of this type of roof only rises 8° C above the air temperature under conditions of full sun and no wind. Dark-coloured ceramic and concrete tile roofs can, according to Satwiko, (2002) absorb solar radiation readily, and their temperature can reach up to 50° C above the air temperature. Although ceramics are heat insulators, they will release the absorbed heat both to the inside of the building and to the surroundings long after the sun has set.

Standard government funded primary schools in Malaysia are usually built with a concrete structural framework and concrete floors and foundations. The walls are not insulated brick or concrete block infill constructions. The roofs are usually dark coloured concrete tiles with aluminium foil reflective insulation under the tiles. These buildings, which are usually two or three storeys high and usually built without wide overhangs to the roof, are heat traps in a tropical climate. Usually there is no strategic tree planting to shade the roof and the walls, and also the height of the buildings can make the important heat mitigating effect of trees negligible, above the first floor level.

The prototype classrooms developed in this research follow the recommendations of most authors for suitable building types for hot-humid climates. The recommended prototypes for further study and performance monitoring are timber-framed, open structures, built of durable hardwood. The floors are timber, elevated and ventilated. The roof is to be constructed of an insulated, reflective corrosion protected steel plate (Galvabond, white Colorbond or similar) and internally lined with timber. Both the one storey classrooms and the two storeys cluster centre buildings are to be built with wide overhangs and trees planted strategically, to shade both the roof and the walls (where these exist). The one storey classrooms are to be built without walls. Open, lattice-wall screens could provide visual separation from the outside where needed, while allowing ample cross ventilation to the inside space. The ventilated and elevated floors and the central ventilated opening in the roof assure vertical ventilation.

Existing standard school buildings are built of relatively low maintenance material and one can assume that they can achieve at least 150 years of serviceable life in a tropical climate. They will, however, need major periodic upgrading, as do most masonry buildings in the tropics. Without periodic re-finishing, they can quickly become shabby and mouldy in the hot humid conditions.

Although timber is no longer considered a durable building material in the tropics, an open-framed timber building (if built of durable hardwood) can have a number of advantages over masonry construction. Weather-protected and openly

ventilated timber is fairly durable, even in tropical, hot and humid climates. Maintenance and repairs to the structure are easy and inexpensive. Protection against termite attack is feasible and a termite attack is highly visible on an elevated, open structure and can easily be prevented, given that reasonable maintenance is carried out on the buildings. One can safely assume that they will have a serviceable life similar to that of the standard masonry school buildings, at a much reduced initial construction cost and lower further maintenance costs (refer to Tables 5.16 and 5.17).

Many writers make similar recommendations for building in tropical and hot-humid climates. However, the existing, standard Malaysian school buildings follow few of the recommendations for suitable buildings in the tropical and hot humid climates. The selected prototype building was conceived to follow all the recommendations of the significant authors who have researched architecture in tropical climates (Keumala, 1992; Karyono, 2002; Nichol, 2002; Majid, Sopian and Denan, 2002 and Satwiko, 2002).

Future expansion options (refer to Table 6.3)

The current Malaysian school complex is a functionally planned entity with further extension options either included or omitted from the site plan. Changes of function of either the building or the grounds are usually difficult to carry out without major construction activity and disruption of the operation of the school. The construction of typical two to three storeys classroom buildings on an existing and operating school site cannot be carried out without providing access for heavy construction equipment, worker access and safety fencing or producing associated noise.

The POE of three government funded primary schools has shown that there are some outdoor areas in each school, which could be used for teaching or learning. There are also purpose designed but limited play areas. The examination of school site plans (Wan, 2000), shows, however, that the outdoor areas are usually hard surfaced, without shade or ground cover vegetation.

The prototype school model developed for this study is a pavilion cluster-type school. The detached classrooms are to be constructed with a simple, lightweight structure and connected to the cluster centres by similar covered ways. The extension of the clusters or the building of a new cluster is a relatively easy and light construction activity. The construction could be made quicker and easier by the off-site prefabrication of the timber classroom units. It is estimated that one prefabricated unit could be erected, finished and handed over for teaching within one week, with minimum disturbance on the site. On-site/one-off construction could be more time-consuming, but a single classroom unit could be still constructed within three weeks.

The two storeys, cluster-centre buildings could also be prefabricated for easy erection. Prefabrication would further reduce the costs of these already economic units, compared to standard school buildings. The pavilion type layout of the proposed school model (refer to Figure 5.7), allows for the school to expand, as new classroom units can be located in many configurations on the site. The grounds between the classroom clusters could be used for a variety of outdoor activities in naturalistic surroundings.

In summary, both the existing school type and the proposed new school model allow for the further expansion of a school within the limitations of the school site. The expansion of the proposed model school would, however, be relatively inexpensive and only minimally disruptive of the activities of the school, particularly if prefabricated buildings or building elements were used. The pavilion-type layout of the proposed school model would also allow greater freedom of site planning and design of future building extensions.

Landscape quality (refer to Table 6.3)

School grounds are usually designed with low maintenance and low costs in mind. Consequently, they often end up as a mixture of low cost hard paving (asphalt or gravel) some grassed surfaces and limited tree planting. Play equipment is usually bought from manufacturers' catalogues.

Most recent Malaysian primary schools have designed school grounds. The emphasis is usually on a hard paved school assembly area, car parks, and decorative front entry gardens and sports areas. There is usually some form of play equipment and some tree planting. Some older rural schools are surrounded with only a multi-purpose and utilitarian gravel or asphalt area.

Little thought is given to the climate ameliorating effects of landscape surfaces and strategies, such as shading of buildings by trees, as discussed in Section 3.12.4. Neither the opportunities for outdoor teaching and learning, nor the exploration of the natural environment seem to be taken into consideration in the design and layout of the average school.

Beer and Sheat (1992a, 1992b), (refer to Appendix A) and Simpson's thesis (1983) *The physical environment of the school*, demonstrate a link between learning and play and the influence of the environment as a tool for teaching, learning and play. In particular, Beer and Sheat's (1992a, 1992b) work considers the social integration, which occurs when children and adults from different cultural backgrounds worked as a team in government comprehensive primary schools in Sheffield, England. This research confirms differences in thinking ability based on social and cultural interactions and children's physical interaction with the environment, as Kong (2000) also found in their research. Simpson's (1983) unpublished thesis on the physical design of Tasmanian government primary schools, demonstrates opportunities to link school subjects and buildings using the outdoor areas as transition spaces for teaching, in preference to indoor classrooms.

Other factors contributing to the research are the ideas and the perceptions about landscape quality of the planning and design professionals surveyed, including an urban and regional planner, an architect, a landscape architect, groups of Malaysian primary school teachers and a primary school education officer, whose opinions have been considered as a database for the interpretation of the proposed improvements identified in this research.

It is difficult to define landscape quality because it varies by culture, climate and geography. Moore (1988, pp.26-45), the renowned architectural theoretician and practitioner attempted to identify some of the elements, which make a quality landscape, they are as follows:

- Sunlight and shadow;
- Stone, earth and water;
- Leaves and blossom;
- Architectural context; and
- Sounds, scents and breezes.

It can be assumed that if the above are designed to be in harmony with each other, a quality landscape is the end result.

Moore (1998) also wrote about the importance of the designed elements of the built landscape. They can be identified in general terms as:

- Shaping or moulding the ground;
- Covering the ground;.
- Raising landmarks;
- Edging and walling (by plants such as creepers or climbers or architectural means);
- Enclosing and opening;
- Roofing;
- Connecting;
- Irrigating and draining;
- Lighting;
- Warming and cooling;
- Scenting;
- Filling with sound;
- Cultivating;
- Populating and inhabiting; and
- Furnishing.

According to the Literature Review (Chapter 2) an important element in the traditional Malay landscape was the connection between the interior, built spaces

and the exterior environment. Similarly, in most hot and mild countries and cultures from classical Rome through Arabic Spain to Moghul India, tropical Latin America and present-day tropical Australia, there were strong and direct connections between the interior and exterior spaces. It is generally accepted that the environment influences the behaviour pattern of all people. The question arises of how the usually utilitarian school grounds of a standard school can provide all, or even some, of the above briefly mentioned necessary landscape elements, to provide an exciting and valuable experience to the children who spend the majority of their daytime hours in the school environment.

The schematic school grounds design developed for this study cannot give an answer to all the above issues. It is a framework design intended to demonstrate that a pavilion type school with clusters of open-air, but sheltered classrooms could fit into an average Malaysian suburban school site while still allowing for a variety of landscaped spaces between the clusters.

The landscape design proposal is based on minimising the hard paved areas, moulding the ground to create spaces and enclosures and using trees to provide shade, while allowing ventilation across the site. A built pilot project will require a detailed landscape design observing the principles researched in this study. The synthesis of the findings of the literature review have led to the supposition that the landscaping of the physical layout of the primary school can influence the way in which children learn. Many researchers have confirmed this supposition, including Kong (2000) and Holloway and Valentine (2000). Opportunities may exist for the Ministry of Education immediately to improve the school environment based on innovative landscape solutions as suggested by Rutledge, 1971. This may result in more innovative designs, which nevertheless remain within the annual Malaysian budget allocation (Mohd, 2001)

Table 6.3: Comparisons of the proposed school model with current practice

	Current schools		Proposed School Model		Source of assessment
Climatic performance	With mechanical system only	**	Building type as recommended for hot-humid climate	***	Architectural science literature review
Economic performances	Standard building costs	*	Approximately 50% saving of building costs. Little maintenance and energy use.	***	Quantity surveyor's estimates
Building materials and structures	Standard building materials and structures with high maintenance (painting every year) and energy use.	*	Simple structure, renewable material, recycle material and heat reflective roof	***	Structural engineer's opinion
Future extension options	By additional standard buildings	**	Easy extension by inexpensive pavilion type buildings	***	Building professionals responses
Landscape quality	Usually poor, with little regard to variety	**	Landscape can be developed in conjunction with buildings to provide climatic ameliorations. Direct connections to the naturalistic landscape. Heat absorbing landscape surfaces.	***	Examination of existing school site plans and the proposed school model

Key: * non existent, ** weak, *** strong

Potential for user control of the environmental conditions (refer to Table 6.4)

In Malaysian primary schools the ability of the users of a school building to ameliorate the physical surroundings to make the place climatically more comfortable is an important issue. Since the second half of the 20th century, the general approach has been to depend on engineering-mechanical solutions such as central heating, air-conditioning, and mechanical ventilation. Using such methods almost all buildings can be made climatically comfortable, often with significant reductions to installation, operation and maintenance costs.

Hawkes' (1996) study indicates that in the five primary schools chosen for a study, a variable classroom environment is preferred to one with fixed climatic and lighting, standards. Responses to Hawkes's questions are proposed in the Table 6.4 and can be summarised as follows:

The standard school building in Malaysia gives some limited opportunities for the users to control the environmental conditions of the space they are using.

Air movement and temperature control is usually restricted to mechanical means, such as electrical fans. Some classrooms are equipped with sun-shading blinds.

There is very little opportunity in a standard school to change the teaching venue to one that offers better climatic and lighting conditions at certain times of the day.

Table 6.4: Comparison of the potential for user control

	Current schools		Proposed School Model		Source of assessment
Q1: What is the potential for variation of environmental conditions, which is offered by buildings of different types?	All buildings are the same type	*	Model offers 2 types of buildings with different environmental conditions	***	Value judgements
Q2: What are the potentials for the occupant of buildings to take active steps to modify the environment and at what point?	Minimum modification with mechanical ventilation at high temperatures	**	Little need to modify the environment	***	Value judgements
Q3: How wide is the estimated range of conditions, which can be tolerated within the tropical comfort spectrum?	Around 27° C (Majid, Denan and Sopian, 2002)	**	Around 27° C (Majid, Denan and Sopian, 2002)	***	Value judgements
Q4: Does this toleration demand changes in activity patterns?	Few options to change activity patterns	*	Option to conduct classes indoors and outdoors	***	Value judgements

Key: * non existent, ** weak, *** strong

6.7 Investigative Issue 5: The perceived need for improvement of outdoor classrooms spaces

This research hypothesised that a new type of building, using architectural elements of traditional Malaysian vernacular architecture, could create an improved human comfort environment without air conditioning. However, the development of traditional Malaysian architecture has not been studied to a sufficient extent to justify definite conclusions (Abu, 1990; Keumala, 1992; Wikantari, 1994; Satwiko, 2002;

Mohyuddin and Yusuf, 2002). However, it can be assumed that vernacular building methods evolved as a result of the occupants' experience and represented local solutions to specific physical circumstances. This assumption is based on the observation that a number of traditional building designs answer the same climatic problem by using the same principles in different ways. Every type of traditional Malaysian building was originally designed to solve interior comfort problems. (Keumala, 1992; Nicol, 2002 and Karyono, 2002). According to Fanger's (1985) theory of evaporation, air humidity can be reduced by air movement. The traditional Malay buildings use a similar principle in their roof design, openings and raised floors on posts (for security and ventilation).

The early colonial Chinese shop houses focused on the natural 'stack effect' for ventilation. This differs from the planning concept of most new building designs, where less consideration is given to natural solutions because of the interest in mechanical solutions.

The application of mechanical ventilation requires a large financial outlay due to both the installation costs and the energy it consumes. Moreover, its usage would usually not consider the physical surroundings (Keumala, 1992). Today, architectural planning and design for tropical climate have begun to consider not only climatic issues but also energy efficiency (Karyono, 1995a; 1995b). For this research the post-occupancy questionnaire assessment of existing school buildings helps to reinforce the above problem. The literature also stresses the importance of human comfort in the tropical Malaysian environment, an issue underlying much of this research.

According to recent research findings (Keumala, 1992), the most critical period for human discomfort in schools is from 1.00 pm to 4:00 pm (refer to Table 3.8). Majid, Sopian and Denan (2002) recorded minimum and maximum temperatures in 2002 for eight varied outdoor areas in an educational institution in Kuala Lumpur, for open, shaded and non-shaded areas the temperatures, each of which were separately recorded. Their readings showed mean temperature ranges from 29.5° C to 33.3° C in outdoors but non shaded areas and mean ranges from 27.6° C to 31.6° C for outdoor shaded areas on the same sites. Air velocities were low on the recorded sites (0.2

metres/second to 0.9 metres/second) as they used enclosed courtyards for taking measurements.

The work of Keumala (1992) and Majid, Sopian and Denan (2002) shows that simple shading, such as an insulated roof, can achieve a reduction of 1.7° C to 1.9° C in the ambient temperature. This technique is applied in the proposed model (refer to Figure 5.7).

The proposed model also fits with the insulation research provided in the literature review as mentioned above. This model offers open classrooms which are simple, open-sided, roofed structures (refer to Figure 5.7). It can be safely assumed that the proposed prototype classroom design, with ventilated floors and conventional, Malaysian type ventilated but insulating roofs, could achieve a minimum of 2.5° C temperature reduction on the shaded interior area of the structure. If the design is combined with suitable site orientation and landscape design, it will allow and aid air movements on site. An estimated reduction of the temperature between 11:00 am and 4:00 pm to within a range of 25° C to 29° C would bring the climatic comfort level of the open classrooms significantly closer to the desired 27° C to 27.8° C thermal neutral area. This represents an improvement over the traditional enclosed classroom, which typically has a temperature range of 24.8° C to 32° C (Keumala, 1992).

6.8 Responses from Malaysian building professionals

To test the model and its applicability to the Malaysian context, an in-country study was undertaken involving relevant practitioners. Mailing the design diagrams of forty types of classroom model construction to a reputable and registered structural engineering firm in Malaysia tested the technical feasibility of the prototype design models. In a similar fashion, an experienced and registered firm of quantity surveyors was approached. Both firms are experienced internationally (established for more than 20 years) and are regularly involved in Malaysian primary school design costing and construction.

The response from the structural engineer was received via telephone conversation. The quantity surveyors returned a tabulated costing for the estimated per square

metres cost of each ten metre by ten metre (100 square metres) model structure, including the specified floors and finishes. The figures could then be compared with standard school classroom costs, as supplied and approved within the budget allocated to the Primary School Department by the Malaysian Department of Education.

The responses of the structural engineers and quantity surveyors are limited by their nature to 'functional' criteria, which are generally acknowledged as essential. For example, without the approval of the structural engineer, the prototype models could not be considered viable for trial construction and the building cost estimates are also essential to gauge the financial viability of the proposed prototype structures. Following is a description of this phase of the study and the findings, as analysed for confirmation or otherwise, of the proposed models in the questionnaire. Next, the findings are interpreted in the context of broader educational philosophies and environmental issues, as discussed in this research.

6.8.1 Structural engineer

According to the structural engineer, the forty types of structures proposed appear to be logical, practical, simple and durable, as Malaysia does not have strong wind problems or other frequent natural catastrophes such as floods, cyclones or volcanic eruptions. Choice of structure varies, from the most economical types of building material to the most expensive. This requires less construction time and is applicable to future applications of the model (refer to Appendix D); for example, for new school building structures to accommodate future expansion. In addition the structural engineer considered that this type of structure would break the pattern of monotonous high-rise school buildings.

The results indicate that none of the offered choices would create structural problems. In fact, students could be involved in constructing some simple structures as a teaching tool for group work (learning by doing). The *muafakat* (cooperation) practice is diminishing in present day Malaysian pluralist society, especially in the cities. However, with proper organisation, parents and teachers could adopt the idea of building simple structures in the school grounds as a community activity, to help

reunify Malaysian society. In addition, the proposed models would be suitable for prefabricated mass production.

As a result, it was the structural engineer's view that the cost and time savings of building such simple structures, might result in a need for less professional input from structural engineers, lowering costs further (refer to Appendix D for structural sketches).

6.8.2 Quantity surveyors

Two quantity surveyors gave indicative costs for the forty prototype classroom models. In Tables 5.16 and 5.17, the costing study shown is based on the design layout of a hypothetical site in Malaysia, using different materials and simple shelter construction for outdoor classrooms and the same construction and materials as in the main school buildings (refer to Table 5.16). Thirty six costing proposals are shown for outdoor classrooms, using different building materials. These represent substantial cost savings, which may produce a budget surplus, which could be allocated to landscaping the school grounds (refer to Table 5.17 and Appendix D).

However, the models varied considerably in estimated construction costs. Only four prototypes, designed to be built with high technology membrane covers, exceeded the standard 100 square metres classroom construction cost of RM 45,000 (refer to Appendix D and Tables 5.16, Types 1 to 4). The construction estimates of the majority of the proposed structures show possible savings in the range of 37 percent to 83 percent compared to a standard classroom. The least expensive prototype is Type 40 (RM 7, 450) which is a simple, steel framed, galvanised steel, barrel vaulted structure, with gravel paving.

Type 22, with a quality hardwood structure and an insulated roof with timber lining built on a hardwood timber deck, was estimated to cost RM 22.00, representing substantial savings (51%) over standard construction costs. The amended costing is provided in Appendix D.

6.9 Conclusion

In order to encourage environmental awareness, environmental education should begin from the earliest stages of education, instead of beginning during higher education as it does in Malaysia. A typically regimented, square and stereotypical built environment in primary schools in Malaysia reflects the teacher-centred authoritarian system in government funded primary schools. The teachers' group interview allowed a sample of teachers to express their discontent about the current situation, to express their hopes for the future and their needs in relation to teaching, learning and play facilities.

The comprehensive literature review and data collected from the questionnaire shows Malaysian primary teachers' awareness of possible choices of teaching pedagogy: from a simple and relaxed interaction with the environment to the utilisation of the latest technology. This study began with an assessment of pre-industrial age education pedagogy, tracing the development of the system extant in Malaysia. The research suggests that this teacher-centred pedagogy is not able ability to meet the challenges presented by globalisation, and is inappropriate to the needs of a multicultural society. Education theorists and school designers conclude that future schools will need to provide a learner-centred environment. School buildings and their surroundings should reflect modern technology and Critical Regionalist concepts in architecture. Buildings no longer need to be monolithic brick or concrete structures, but should offer sustainable solutions to the regional climate needs of the tropics, incorporating successful elements of local vernacular architecture.

The analysis of the research results has shown that there is considerable need for improvement in the current government funded primary school educational and physical environment. Both the present educational system and the built environment have grown from the former Western colonial background, with little regard for the present needs of a society which is modern, environmentally aware, South-East Asian and in a tropical and hot, humid climate.

The typically regimented and stereotyped school environment in government funded primary schools has led to a teacher-centred, authoritative teaching and learning

environment. The teachers' group interviews showed that the teachers themselves are concerned with the present lack of opportunities to develop imaginative, new methods for learning and play.

This research has analysed relevant literature concerning cognitive development in early childhood and the impact of space on children's development. Recent studies have suggested that interaction with the environment is an important aspect of children's cognitive and social development, particularly in highly urbanised Asian cities such as Kuala Lumpur where, increasingly, children have minimal contact with outdoor environments.

Only token attempts have been made to change the existing curriculum in most schools, in line with the highly publicised and government-sponsored focus on environmental awareness in school children. In most schools this is partly due to the lack of suitable outdoor and landscaped facilities where students are able to develop safe and guided connections to the natural environment.

Most existing Malaysian primary schools do not have full air-conditioning, Therefore, they experience heat related human comfort problems regularly especially in the early afternoon period. The rigid nature of most existing school buildings and grounds usually offer few opportunities to change activity patterns to alleviate the discomfort.

The architectural science and functional aspects examined in the comparative analysis and assessment clearly show that the proposed school model could provide significant savings in building costs and a significant improvement in climatic performance, compared with existing schools. These potential improvements are supported by professional assessments of the proposed building model.

The comparative analysis and assessment of the current school model and the school model developed for this research has shown that the new school model has the potential to overcome, or at least significantly improve, most of the problematic aspects of the existing school environment identified in this study.

CHAPTER 7: CONCLUSION

7.1 Introduction

Malaysian education is still largely based on the British system, which existed prior to Independence (1957). Malaysia has not yet incorporated the contemporary pedagogical or architectural changes, which have been introduced in Western countries in response to recent research into children's cognitive development and new movements in architecture.

This millennium, the United Nations is dedicating its work to children and a major part of childhood is school life. Research in the field of education, psychology and architecture suggests that a major contribution to children's learning can be achieved by child-friendly design of schools and school grounds. Play is certainly an area of activity in which children's natural curiosity guides what they learn. The extant research into children's cognitive development suggests that a more flexible use of teaching spaces may foster children's imagination while contributing to their spatial awareness, intellectual and emotional development and acquisition of social skills. The use of outdoor spaces can encourage the development of the 'complete child', when incorporated into teaching spaces in a student-centred curriculum.

The notion that play is only an exercise is disputed by the research in this study. Children have many developmental needs (including physical development), which are satisfied by play. These include social and emotional needs, such as a sense of self-esteem. Play also helps to create a sense of independence and initiative as well as fostering many other emotional, social and intellectual accomplishments. While learning through play, children develop individually, learning to relate to a group, to interact and fit in. They learn to share outdoor spaces, curriculum materials and develop tolerance of others.

Children can become socially and intellectually malnourished as a result of lack of stimulation, due to boring and unvaried experiences at an early age. It is therefore important that the school environment designed for the purpose of play and learning

should provide not only different kinds of experiences, but should also stimulate children to explore and manipulate their environment.

Architectural culture including identity has often been problematic in former European or British colonies in Asia. Iconic buildings of the colonial past could be preserved as school buildings in Malaysia as they are in many Western countries. However, additions to existing schools and new school buildings should be climatically responsive, environmentally sustainable and also reflect Malaysia's cultural heritage. They should also provide contact with nature, which is lacking in the increasingly urban environment in Malaysia.

The intention of this research was not to redesign the primary school system of Malaysia, but to determine whether primary school environments could be improved by incorporating outdoor classroom space into existing schools. This research investigated stakeholders' perceptions of the need for change in both pedagogy and architecture and concluded that there is a perceived need for change in both of these areas. The second focus of the research was architectural. The aim was to test a classroom model, as a preliminary guide to stakeholders' perceptions of the type of school structure and landscaping of school grounds, which might meet the educational and thermal comfort needs of Malaysian primary school students and staff, within a realistic budget.

The conclusions were derived from the questionnaire and interview, the costing estimates and thermal comfort measurements suggest that it would be possible to initiate the development of an environmentally sustainable and educationally innovative physical environment for Malaysian government funded primary schools, which could provide better quality teaching and learning spaces and better human comfort solutions.

7.2 Responses to the Research questions

Research question 1: What is the nature of current teaching and learning spaces in government funded primary schools in Malaysia?

The findings of the Post Occupancy Evaluation of selected government funded primary schools in Malaysia support the need for improvements to the current school model.

Following are the research findings identifying existing school problems, which appear to contribute to the current unsatisfactory situation in Malaysian primary schools:

- Climatic human comfort problems occur in most existing school classrooms, particularly in the early afternoon school hours (from 1:00 pm to 4:00 pm).
- A number of professionals are concerned that current teaching spaces are less than ideal and fail to stimulate creative learning.
- There are some pedagogical concerns that a freer and more varied environment might result in less discipline, which could affect teachers' authority and student learning outcomes.
- Unattractive and confined play areas without connections to a larger and well-landscaped open space limit children's play settings, and such spaces invite conflict between children thereby affecting their ability to socialise and learn.
- Most existing school grounds are not suitable for outdoor teaching and learning as the utilitarian nature of most of these limits outdoor activities to physical education-type games and exercises on ball courts.

These findings suggest that the current school system and physical environment provides few possibilities for unstructured learning. Although some school facilities have changed in the past century, the teaching pedagogy in Malaysia has not altered significantly. This pedagogical conservatism is reinforced by the questionnaire and interview data from primary teachers, several of whom expressed some concerns that a freer and more varied environment might result in less discipline, which could negatively affect teachers' authority and student learning outcomes.

Research question 2: How can alternative models of school teaching and learning spaces assist primary school environments in Malaysia?

The evidence from the literature review and the results of the data analysis support the view that increased interaction with the external environment would facilitate learning across the curriculum.

The research results and the school model developed in response to the data from the research questions have shown that it is possible to design a school to fit Malaysian climatic conditions without using mechanical cooling. Such a school can relate both aesthetically and functionally to the cultural traditions of the country, while also following ESD principles.

Alternative models of teaching and learning suggest that learning and play environments should provide a variety of activity settings, surfaces, textures and equipment, incorporating sand, water and other nature elements to stimulate children's learning and development. Such school environments could be better labelled a 'playlearnscape' ('playscape' and 'learnscape'). Alternative models of school learning and teaching spaces would provide a landscaped outdoor environment which is carefully designed and planned to support activities that are an essential part of the child's learning development (physical, emotional, social and intellectual). Ample opportunities should be provided for children to have a connection with nature, in a place of their own that is secure against adult intrusion, yet accommodates adult concerns for ease of supervision.

Alternative models of school teaching and learning spaces should provide the following: active and quiet areas, soft and hard surfaces, simple and complex environments and informal sitting places for children and adults. They should also allow for after school hours community activities. As suggested by this research, security of school premises is becoming an increasing problem in Malaysia because schools are not used outside school hours. Alternative and more imaginative design of both the school building and grounds would allow after hours community use of facilities, which would provide community surveillance of the school.

Activity settings for children of various ages at different stages of development should be available on the same site. As proposed by Montessori and Vygotsky, the use of the outdoor classroom by multiple age ranges encourages zones of proximal

development where children of different ages and stages of development can interact and assist each other's learning. Furthermore, such learning environments allow manipulation of the environment, employing natural elements such as sun, wind, vegetation, water and sand. The school grounds would include nature as an important stimulant to a child's learning and development, through all five senses, in a natural setting that will attract birds, animals and insects, thus enriching the learning environment further. Introducing nature as a teaching and learning tool encourages respect and a sense of responsibility towards nature in children. Through observing natural processes they will learn patience and goodwill, which will benefit society generally.

The proposed school design accommodates children's need for a place of their own. It also encourages adults to relax, retreat, linger and pursue sports and other community interaction activities outside school hours. Creation of creative leisure, play and learn spaces for all ages can be a positive influence on the development of social and community attitudes. This leads to satisfying recreation and high levels of satisfaction with the physical environment where people live, which in turn promotes a stable community.

The prospect of less spending on maintenance should find favour with governments. In addition, the substantial construction cost savings proposed in the hypothetical classroom model would provide funds to develop the school grounds to contribute to both the climatic amelioration of the site and the buildings.

The formalised model suggested in this research, as well as offering substantial improvements to human comfort in tropical Malaysia, is feasible for primary schools in Malaysia as they are less costly than the current costing for standard government primary schools.

7.3 Limitations of the research

There are major potential improvements suggested for the examined educational aspects of Malaysian primary schools. The educational improvements, however, can only be evaluated as potential improvements. More definitive conclusions in this

area could only be fully established after monitoring the effectiveness of a built pilot project.

The four theoretical questions related to the potential environmental control of schools by the users were derived from Hawkes' (1996) definitive work. The questions are theoretical and therefore the analytical answers can only be theoretical. They do show that the proposed new school model has significant potential to provide a more comfortable teaching and learning environment compared to current standard school building designs and site layout, utilisation and landscaping.

Another limitation of this research is that no consideration has been given to design interventions for the disabled in standard government primary schools, due to the existence of disabled schools as totally separate entities in Malaysia. Many of the design changes advocated are also suitable for inclusion in schools for the disabled.

Additionally, there are factors that were not considered in this research, such as pollution factors, for example, regarding the contribution of air-conditioning of schools to the urban heat load in Malaysian cities. Also, issues such as noise and air quality of open-air classrooms in dense urban areas were not considered. Detailed examination of these issues is outside the scope of this research but could provide useful avenues for further research.

The sample size of building professionals is small. However, it was argued in Chapter 6 that it could be considered representative as each of the building professionals has been involved with many school design projects and are considered to be experts in their respective field.

In brief, a review of the history of Malaysian education and an overview of teaching methodology and relevant research in this area has not resulted in fully conclusive support for the use of outdoor classrooms in primary schools in Malaysia. However, nor has it indicated major negative implications of this concept. The qualitative research questionnaire and interviews and the quantitative data from the building

professionals surveyed has generally supported the concept of outdoor classroom use, although this support is qualified and based on a small sample.

7.4 Further Research and Recommendations

The guidelines for the prototypes in this study could be applied in different schools, although each school will have its own site requirements and priorities. It is hoped that in future this research will be used as a resource or guidelines to inform the design, or redesign of school grounds.

The findings related to the hypothetical classroom model in this research are theoretical. To validate the research findings in a real teaching and learning situation a pilot model school would need to be built and assessed for a considerable length of time. The pilot project need not necessarily be a full primary school designed and built using the research recommendations. In fact, the building of one or two experimental clusters of open-air classrooms with a naturally ventilated central building within the grounds of an existing school could be a viable solution. This would allow for the parallel monitoring of both pupils in traditional classrooms and in the new, experimental ones within the same school and climatic and social conditions. Thus, further research is needed to build and test the prototype model in a real life context. Feedback from a wide range of stakeholders could then be obtained over an extended time period.

There is no major strong wind problem in Malaysia and the average wind velocity in Malaysia is 0.5 m/s. Wind velocity is important since air movement within the classroom may disturb the teaching process. In general, a wind velocity of more than 1.5 m/s will disturb loose paper. Therefore, potential problems with air movement within the outdoor classroom could be evaluated.

This research suggests that if suitable outdoor teaching and learning spaces were designed to suit the Malaysian tropical climate and its unique culture, as well as incorporating modern global perspectives on education, teachers would regard this as a positive improvement. Teachers interviewed and surveyed generally supported the

introduction of outdoor teaching, learning and play spaces, designed in accordance with the behavioural needs of children and the Malaysian way of life.

7.5 Conclusion

This research has laid the groundwork for further research towards the development of a school model, which could suit Malaysia's tropical, hot and humid climate and unique multicultural society. Most stakeholders interviewed regarding the hypothetical school model expressed a positive reaction. This indicates that stakeholders were ready to accept changes in both the architectural design of school buildings and improvements in educational methods. The findings suggest that the development of a unique Malaysian school model, incorporating climatically responsible, environmentally sustainable design of schools, and having a student-centred pedagogy could bring Malaysia to the forefront of primary school education in Southeast Asia.

Recent development at the global level in architecture acknowledges the importance of the environmental awareness of the traditional inhabitants of many lands by focussing on ESD issues in building design. This research adds to the body of knowledge in this area and suggests further directions to improve the design of primary schools in Malaysia.

As a postscript, traditional Malaysian society is expressed in its understanding of the essential connection between mankind and the environment in the idioms of *Bahasa Malaysia*, as follows:

*Jika mahu tahu tingginya pokok tanyalah pada helang,
Jika mahu tahu luasnya padang tanyalah belalang,
Jika mahu tahu dalamnya hutan, tanyalah puyuh,
Jika mahu tahu panjangnya pantai, tanyalah bebarau,*

Translated as:

To know the height of a trees ask the eagles,
To know the width of a field ask the grasshoppers,
To know the depth of a forest ask the birds,
To know the length of a beach ask the seagulls,

and

*Kalau Sudah Sampai Ke Puncak Gunung,
Jangan Lupa Tunduk Melihat Rumput Di Bumi.*

Translated as:

After reaching the summit, do not forget the grass on the ground.

And a Chinese idiom:

Gao su wo, wo hui wang ji, zhan shi wo, wo, hui ji de, chan yu, wo hui ming bai.

Translated as:

Tell me, and I will forget; show me, and I may remember; involve me, and I will understand.

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APPENDIX A

POTENTIAL FOR CONNECTIONS BETWEEN MALAYSIAN PRIMARY SCHOOL CURRICULUM SUBJECTS AND THE SCHOOL GROUNDS

Table A1: Activities relating language subjects to the physical environment

Report writing	Oral reports
Poetry writing	Library researching
Discussions	Listening
Comprehension	Descriptive writing
Interpretive writing	Summarising
Creating encyclopaedias	Poetry readings and poetry writing
Speech making/ Oratory	List making or annotated lists
Presentations	Reporting sessions
Storytelling	Creating trails signs for information for nature trailing
Negotiation	Creating catalogues
Keeping written records	Creative writing
Letter writing	Brainstorming sessions
Diaries	Making journals and books
Survey and interviews	Creating dictionaries
Log books	Literature readings
Story writing	Conducting guided tours
Duty roster	Short walks
School newspaper or newsletter	Cue cards
Communications	Tick charts or word cards

Table A2: Activities relating music to the physical environment

Singing	
Writing songs	Recording sounds of wildlife—birds chirping, bees buzzing, insects humming.
Musical performance with echoes-	Recording sounds of nature- rainwater-falling, gushing, splashing..
Dubbing music	constructing and playing instruments from nature-leaves, trunks, coconut shells, bamboo

*Indoor spaces could be used for storing musical instruments and for classes during bad weather. The challenges from the environment,(for example: the landform, vegetation, wind and rain) could be part of the play and produce learning ideas in the informal curriculum.

Table A3: Activities relating Drama to the physical environment

Role Play or pantomime	Video making
Script writing	Drama or theatre workshop
Creative dance workshop	Outdoor dramatic productions

Table A4: Activities Relating Mathematics to the physical environment

Percentages and proportions	Costs
Maths games	Sorting and grading
Calculating area	Direction and vector work
Measuring weights, lengths, angles, volumes, heights, rates (metric - imperial) velocities, depths, perimeter, diameter. Tangent and perpendicular	Rates of currencies and time zones changes Databases, data analysis, statistics, poll.
Shapes and geometry	Time and mass studies
Estimating and checking	Counting
Data analysis and statistics	Dimensions
Spatial and numerical relationship	Triangulation
Quantity surveys	Trigonometry and geometry
Graphs, pie charts and tables	Approximating
Skills of independence and survival negotiating	Commerce skills (bartering, trading: early monetary systems eg. using shells, leaves as currency)

Table A5: Activities relating Economics to the physical environment

Fruit, flower, vegetable production Processing products Design of production areas Accounting Harvesting processes Cooking harvested produce	Resource management projects Conservation of resources Book keeping Home Economics- grocery budgets Recycling projects
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Table A6: Activities relating Information Technology to the physical environment

Computer graphics	Spreadsheets
Inventories	Databases
Simulations	Simple CAD

Table A7: Activities relating History to the physical environment

Coppicing	Brick-laying
Stone wall building	Hedge
Plants of historic value	Building ancient structures
Kilns	Primitive housing / shelter
Simple archaeology	
Reading Time : Sundials, hourglass, water clocks	

Traditional power sources

Wind Lightning	Solar flowing water
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Table A8: Activities relating Art, Craft and Design to the physical environment

Stencil and photo-stencil work	Needlework based on patterns: eg. – dragonfly wings
Collage and montage	Recording and interpreting nature using: drawing or painting, collage,
Aesthetic appreciation exercises – like and dislike	
Designing new spaces	Basic armoury (horns, blow pipe)
Making models of existing and imaginary objects	
Natural dyes – textile art (making leaf, spore and seed prints)	Plaster casts
Display and exhibitions	Filming wildlife
Designing symbols	Quick sketching techniques:
Lifecycle drawings	Patterns and making natural objects
Photography courses	Pencil rubbings
Carving and sculpturing	Environment silhouettes
Life web mobiles	Clay and plasticine modelling
	Colour and shape studies
Creating picture books	
Making murals	

Table A9: Activities relating the Sciences and Survival Skills to the physical environment

Presentation of findings	Observing
Recording	Raising questions
Writing reports	Planning investigations
Drawing conclusions	Graphs, pie charts and tables
Identification	Classification
Analysis techniques	Solving problems
Evaluating results and hypothesising	Seeking patterns

Table A10: Activities relating simple Physics to the physical environment

Flight (balloons, rockets, parachutes, plant material, birds, insects)	Movement, travel and propulsion
Sound	Structure and function studies
Experiments with Forces	Properties of fire
Density and mass tests	Properties of gases
Water properties	Velocity

Table A11: Activities relating physical Education to the physical environment

Fitness circuits and stations	jogging trails
Camping skills	Map and compass work
camp cooking	Weekend and overnight camps
Work on health and healthy environments	Dangerous and poisonous plants and animals
Plants for health	Balancing skills
Safe techniques for lifting	Fine motor skills
Orienteering	Nature- based sports

Table A12: Activities relating Biological Sciences to the physical environment

Identification of plants and animals	Classification of plants and animals
Plant growth/ Seed searches	Diaries, journals and log books
Preserving and exhibiting plants Basic environmental science– ecology studies/environmental sustainability)	Botanical study Basic remedies from natural plant and medicinal properties Plant succession studies
Vegetative reproduction	Growth experiments
Ecology and ecosystems Soil ‘micro-life’ experiments	Natural flight in birds and insects Insect trapping and counts
Animal tracks, casts water colonisation studies Plant group studies ‘Ant safari’ Diversity studies	Nature hunts Germination and Habitat studies Death and diseases of plants and animals Water plant studies
Botanical and biological drawing Quadrants and Transects	Colonisation Energy and food chain studies
Fertility experiments	‘Adopt a seedling’ type projects
Predator and prey relationships Plant collection	Plant and animal relationship studies: Plant physiology tests
Feeding patterns	Life in the built environment
Case studies of plants and animals Animal and plant counts	Feeding experiments with insects, birds and animals
Studies of animal movement and direction decisions	Decomposition studies of plants and animals Soil and plant growth tests
Comparing animal life styles Studies of species’ adaptation	Life cycles Bird watching

Table A13: Activities relating Geography and the physical environment

Direction and distance studies	Using maps and plans
Rocks – types and composition	Soil pits
Mapping to scale and map making Surveying	Using compasses and compass points Basic nautical studies
Soil (structure, texture, composition, organic content tests, pH tests) Basic agriculture and land practice- e.g. hilling rice fields, terracing rice fields and drainage systems	People and land use – human geography: Other ways of life. Spatial organisation Basic aeronautical studies
Weather studies, weather station and recording water and soil cycles	Design questionnaires Basic tourism?

Table A14: Relationship between Religious Education and the physical environment

Vegetarianism Veganism	Study of natural Lifecycles – birth, life and death, group work
Caring for and raising animals	Celebration of life
Exercises in : co-operation, sharing, negotiation and compromise	Conservation exercises
Caring for the world Traditional sports and games using the environment Outward Bound (trekking, nature studies) Investigating plants from other lands	Elements of the natural environment used in celebrating: Christmas, Aidil Fitri (end of Ramadan) and Aidiladha), Easter, Chinese New Year, Deepavali, Ramadan, Mothers’ Day, Harvest festival.

Table A14: Uses of English school grounds in school curricula, applicable to the Malaysian primary school environment .

Club-house	Mats for working on
Drama studio or workshop and refreshment stand	Outdoor drama theatre or art display space
Sculpture display area or garden	Radio controlled vehicle-racing area
Dancing space	Working with wood
D.I.Y. area or exhibitions of work	Concert theatre or space
Craft fairs	Paved area
Garages- for work or storage	Meeting spaces with night lighting
Playing guitar	Miniature railway track
Seating	Rubbish bins
Painting space	Mural wall
Smaller games areas: such as walls or fences	Space for listening to radio or music
Modelling area (clay and plasticine)	Sailing model boats
Film-making	Working on cars
Tables for games, and work and self defence classes	Sheds or shelters

Table A16: Spaces for hobbies, or Arts and Craft areas on school grounds - offering opportunities for informal and hidden curriculum implementation in the physical environment

Orchard: fruit trees and soft fruits	Growing house-plants
Allotments: gardening plots: for: vegetables and medicinal plants	Walled or fenced enclosures: Kitchen garden
Garden sheds (potting, storage)	

The following natural phenomena, if located in school grounds, would have multiple purposes in the curriculum. Table A17 shows possible activities in these spaces.

Table A17: School gardens/nature areas

Nature areas	Activities
Trees	Botanical studies
Tall grass	Wildlife habitat
Grassy patches	As above-seating and play areas
Nature trail	Plant identification/ Wild animal tracking
Wildlife garden (hedgehogs, birds, frogs, insects)	Nature walks/ Butterfly catching
Copse	Playing/observing animals, birds/insects
Biology corner	Observation of frogs insects and small animals
Farming corner (sheep)	Learning animal husbandry
Rockery	Looking under rocks
Bird watching hut Birds nests and boxes Aviary or pigeon loft Butterfly garden/ bird bath Bird tables	Studying flora and fauna -observing birdlife Listening to birds
Piles of cut grass	composting
Fallen tree	Observing insects/climbing
Specimen trees	Shade/observing birdlife
Over grown shrubs	Insect and wildlife habitat
Seating	Can be positioned in a variety of micro -environments –for observation of wildlife and socialising
Wildlife enclosure/ Underground camera for wildlife	Observation of animals
Conservation area (Wild area and untouched)	Rock, fossil collecting
Wildflowers	Botanical study
Sand or rubble paths	Walking
Vegetable plots	growing vegetables
Weeds and mossy grass	Natural habitats for frogs and mosquitoes
Pets corner (mice, guinea pigs, rabbits)	Caring for and observing pets

Table A18: Natural water areas

Bird watching hide area	Trees
Islands	Fountain
Duck pond	Rockery with waterfall
Frogs, newts, toads	Fresh water shrimps
Fresh water fish	Shallow pools
Stream	Bridge
Fish pond	Water striders (water insects)

Table A19: Woodland

Trees	Log cabins
Shrubs	Flowers
Ponds	Mangroves
	Meandering stream / creek

Table A20: Outdoor function areas

	Toilets
--	---------

Snack area (tables with umbrellas) and benches	Plantscapes
Specimen trees with chairs around	Seats
Picnic tables/ Picnic area surrounded by trees	Shrubs
Pond	Line of trees

Table A21: Seating and quiet area

	Chairs
Lounging bank	Water to watch and listen to
Benches	Trees
Planted beds	Table and chair sets
Picnic tables	Tables for outdoor lessons
Sun deck for sunbathing (source of vitamin D)	Fence for privacy and shelter
Grassed area for outdoor lessons	Paved area
Outdoor eating area	Concrete walled enclosure
Pavilion	Tables
grassed areas for relaxing	stream
Bridge	Windmills/ water wheel
Litter bins	Veranda
Flower beds	Concrete shelter

Table A22: Obstacle course

Rope ladder	Climbing wall
Death slide	Weaving poles
Vertical scramble net	Mud jump
Tarzan swing	Abseiling wall
Orienteering course	Jumping ditch
Rope swing	Sand pit
Water jump	Horizontal scramble net
Fitness trail :Running track and grassland	Krypton factor type course

Table A24: Courtyard area

Pond	Seats
Concrete	Flower beds
Specimen tree	Tables

Table A25: Memorial garden

Memorial cross	Trees
----------------	-------

Table A 26: Garden and ornamental areas

Flowers	
Plant beds	
Benches	Shelter
Seating	Hedges
Specimen trees	Specimen shrubs
Fish ponds	Wishing well
Rockery with waterfall	Lower beds
Walls or fences	Walking/strolling/meandering path/ trails
Paved area	Fountain
Grass area	Water follies
Sand area	Grass lawns
Formal flower garden	Grade A wood trees
Sculptures	Grade B wood trees
Paving stones	Peace garden
Formal gardens	Courtyard area
Monuments	Clock tower
Floor art	Wall art
Park shelter	Rose gardens/ local flower gardens

Table A 27: Playground and adventure playground

Swings	Concrete playing area
Ball-only area	Slide
Tables	Steps
Specimen trees	Climbing ropes
Rope swings	Trampolines
Bridge	Underground caverns
exercise yard	Graffiti wall
Walls and fences for shelter	Climbing rocks
Outdoor cooking area	See-saw
Skipping areas	Ball rebound wall
Tobogganing slope	Climbing walls
Tarzan swing	Grass playing area
Bins	Chairs
Different age group areas	Seating around trees
Hollow tree	Arboretum
Ecology museum	Maze and grotto
Tunnels	Climbing frames
Skateboard run	Forts
Rubber matting surface	
Sitting and viewing slope	Steps
Pipes	Wading in water
Camping	Building tree houses
Mounds	Private / secret place

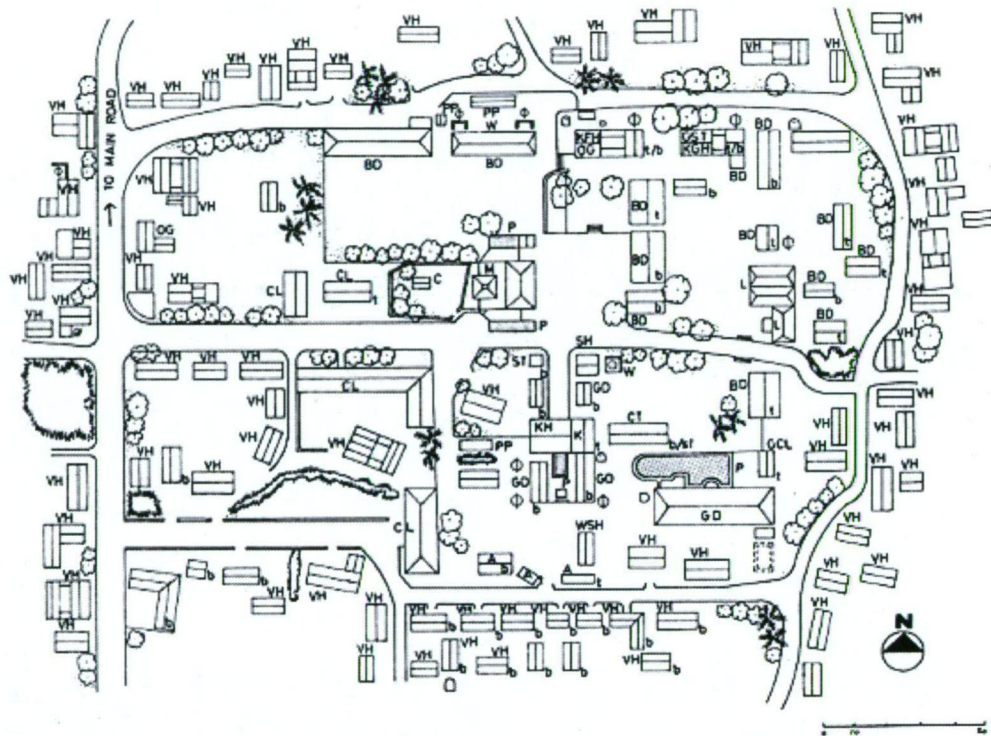
A28: Sports grounds

Running track	Archery range (general)
Scrambling bike track	Skateboarding area
American football pitch	Racing bike track
Outdoor trampolines	Grass tennis courts
Weight-lifting	Long jump
Football fields	Bowling green
Clock golf	Cricket practice nets
Putting green	Tarmac practice area
100m tracks with seating for spectators and Changing rooms	Cricket pitch, clay tennis courts and traditional games area
Pitch and putt	BMX jumps, ramps and bends
Bike sheds	Jogging track
Racquet ball	Outdoor table tennis
Hammer throw	Five-a-side football
Hurling	Micro korfball
Four-a-side football	Australian rules football
Hurdles	Target archery
Roller skating rink	General artificial sports pitch
Outdoor basketball pitch	BMX bike track
Outdoor badminton courts	Javelin
Rounders pitch	Croquet lawn
Touch football field	Crazy golf
Concrete practice area	800m tracks
Rugby pitch	Netball courts
All-weather tennis courts	Mini golf course
Bike repair workshops	Skateboard jumps, pipes and bowls
Handball	Volleyball
Judo and karate	Rugby league
Grass skiing	Korfball
Roller hockey	Field archery
Fencing	Drinking water fountains
Wind shelter	Refreshment stands
Five-a-side football	

(Adapted from Beer and Sheat, 1992a, p.43-46; 1992b, Appendix 1)

APPENDIX B

Figure B1: *Pesantren Pabelan and An-Nuqoyah, Java*. This modern madrasa is an existing example of an original madrasa and its building material is still in the spirit of earlier tropical school building materials (Source: Afshar, 1970, p.29-44.)



KEY:

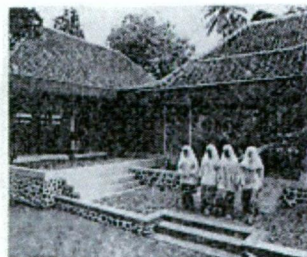
M Mosque
C Cemetery
KH Kyai's house
KFH Kyai's father's house
KGH Kyai's grandfather's house
OG Office and guest house
GST Grain storing office and storage
GD Girl's dormitories
BD Boy's dormitories

WSH Workshop
L Library
CL Class room
K Kitchen
CT Canteen
PP Patisseries
W Wash
SH Shop
ST Store

VH Village houses
GCL Girls class room
A Animal pen
P Pool
W Well
WT Water tank
t Timber construction
b Bamboo construction
sf Steel frame

Pesantren Pabelan, site plan.

Drawing: F. Afshar.



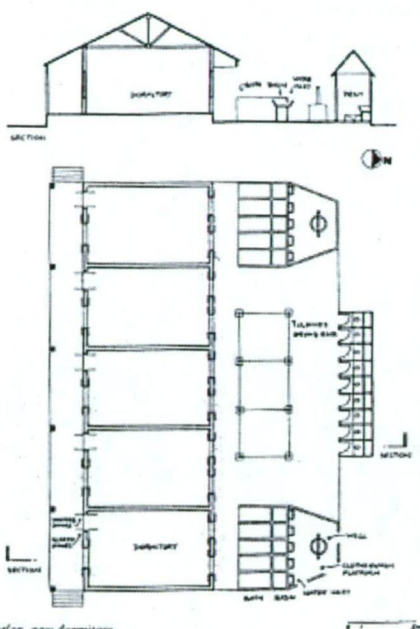
Pesantren Pabelan, exterior of a girls' dormitory.

Photo: C. Little/Aga Khan Awards.



Pesantren Pabelan, library and meeting hall building.

Photo: C. Little/Aga Khan Awards.





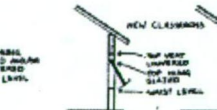





Pesantren Pabelan, new dormitory
Drawing: F. Afshar



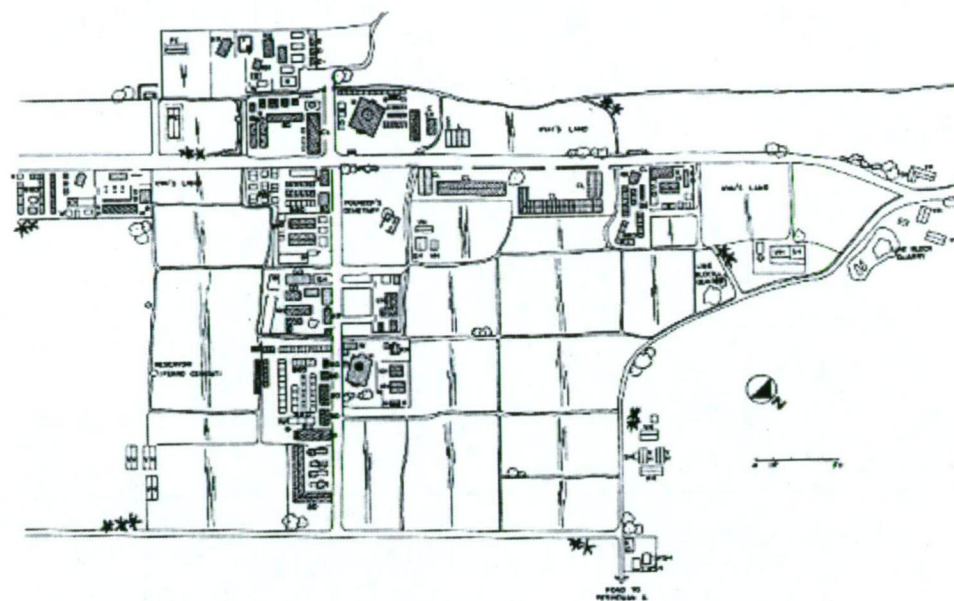
Pesantren Pabelan, interior of a classroom.
Photo: C. Little/Aga Khan Awards.



Pesantren Pabelan, interior of a classroom.
Photo: C. Little/Aga Khan Award.

SLEEPING ON: BEDS (DORMITORIES) (USUALLY ON EARTH FLOOR)	BAMBOO PLATFORMS (USUALLY ON EARTH FLOOR)	BEDDING (ON CONCRETE OR TILE FLOOR)
<p>FLOOR EARTH</p> 		
<p>WALLS</p>	<p>BAMBOO OR TIMBER FRAME WITH BAMBOO PLATTING</p>	<p>BRICK</p>
<p>PLANS AND ROOF SECTIONS</p> 		
<p>VERANDAH</p>	<p>SOME NONE</p> 	<p>SOME PARTIALLY COVERED ALONG SIDES</p> 

Pesantren Pabelan, dormitory and classroom typology
Drawing: F. Afshar.



KEY:

M Mosque
 KR Kyai's reception room
 KH Kyai's house
 O Office
 CO Community development office
 T.WSH Tailoring work shop
 TL.WSH Tile work shop
 VH Village house
 BBD Boys bamboo dormitory

GD Girls dormitory
 BD Boys dormitory
 CL Class room
 K Kitchen
 CSH Co-op shop
 SH Shop
 L Library
 W Wash and/or W.C.
 PC Poultry coop

Well and/or wash
 Spring
 Stone/brick construction
 Bamboo/wood construction
 Cultivated land
 Before '65
 '65-'74
 '74-'80
 '81
 Unknown

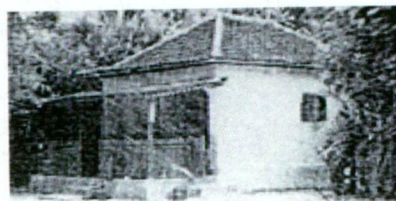
Pesantren An-Nuqoyah, site plan (showing growth periods).

Drawing: F. Afshar.



Pesantren An-Nuqoyah, general view.

Photo: F. Afshar.



Pesantren An-Nuqoyah, Kyai's reception room.

Photo: F. Afshar.



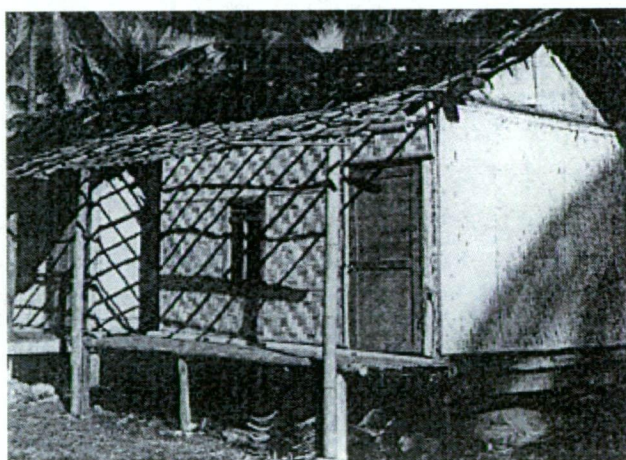
Pesantren An-Nuqoyah, general view of boys' dormitory.

Photo: F. Afshar.



Pesantren An-Nuqoyah, general view Kyai's compound.

Photo: F. Afshar.



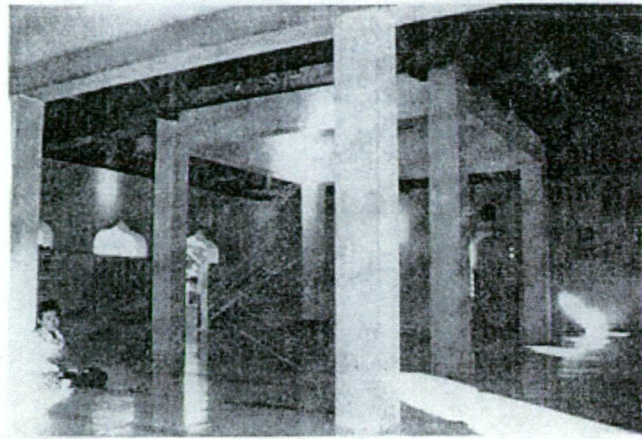
Pesantren An-Nuqoyah, construction of a student dormitory.

Photo: F. Afshar.



Pesantren An-Nuqoyah, exterior of a mosque.

Photo: F. Afshar.



Pesantren An-Nuqoyah, interior of a mosque.

Photo: F. Afthar.

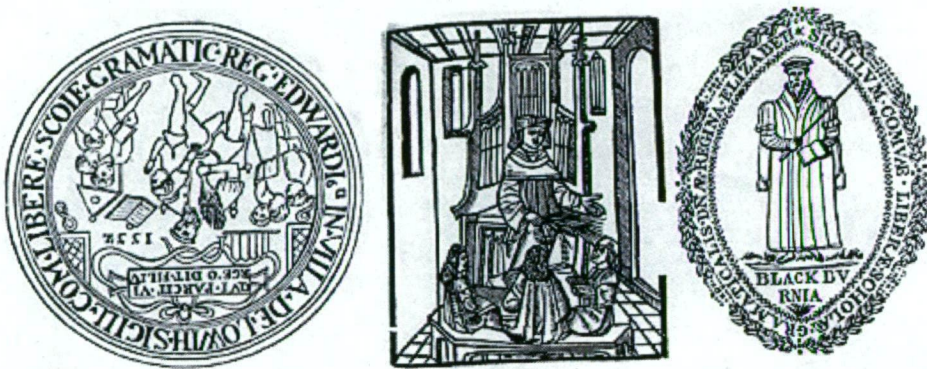


Figure B2: School seals showing teachers holding birches (Sources: Seaborne, 1971)

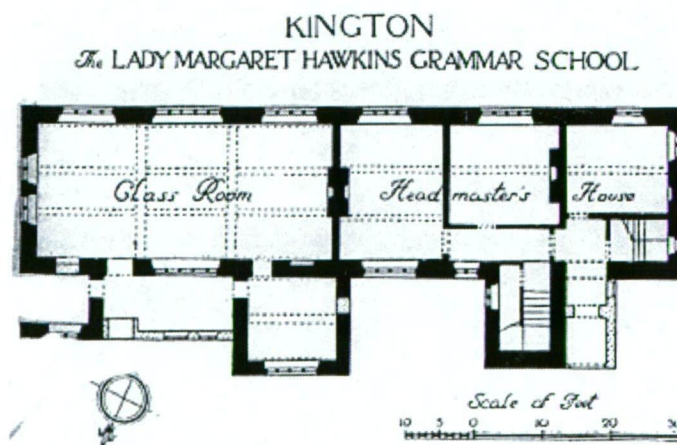


Figure B3: A 16th century school plan of headmaster's house attached (Source: Seaborne, 1971, pp.18-20)

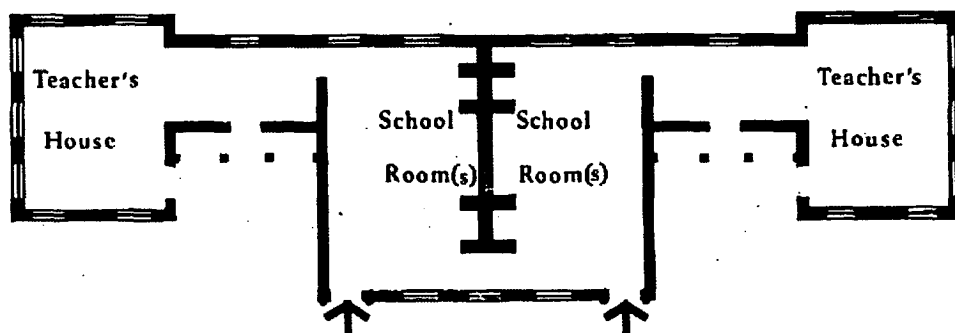


Figure B4: Shrewsbury, Allatt's school, 1800. The plan shows the beginning of the spreading ground floor plan (Source: Seaborne, 1971, p.121)

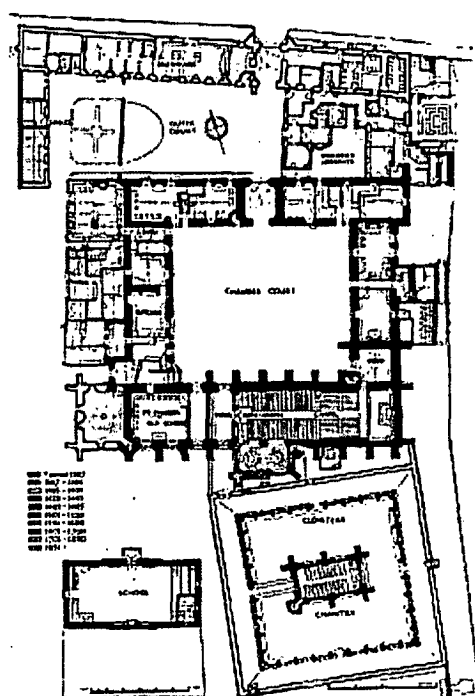


Figure 1: Winchester College, ground plan showing dates of work and state of buildings in 1954.

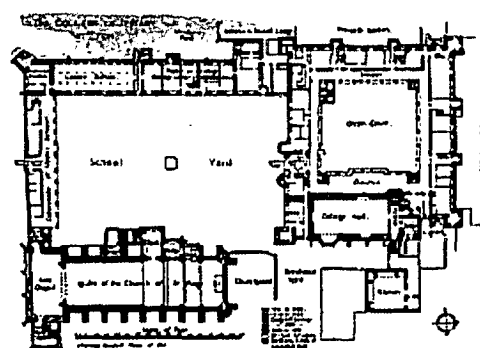


Figure 2: Eton College, ground plan showing dates of building works

Figure B5: Winchester College and Eton ground floor plan, showing dates of building works (Source: Seaborne, 1971, pp.3-5)

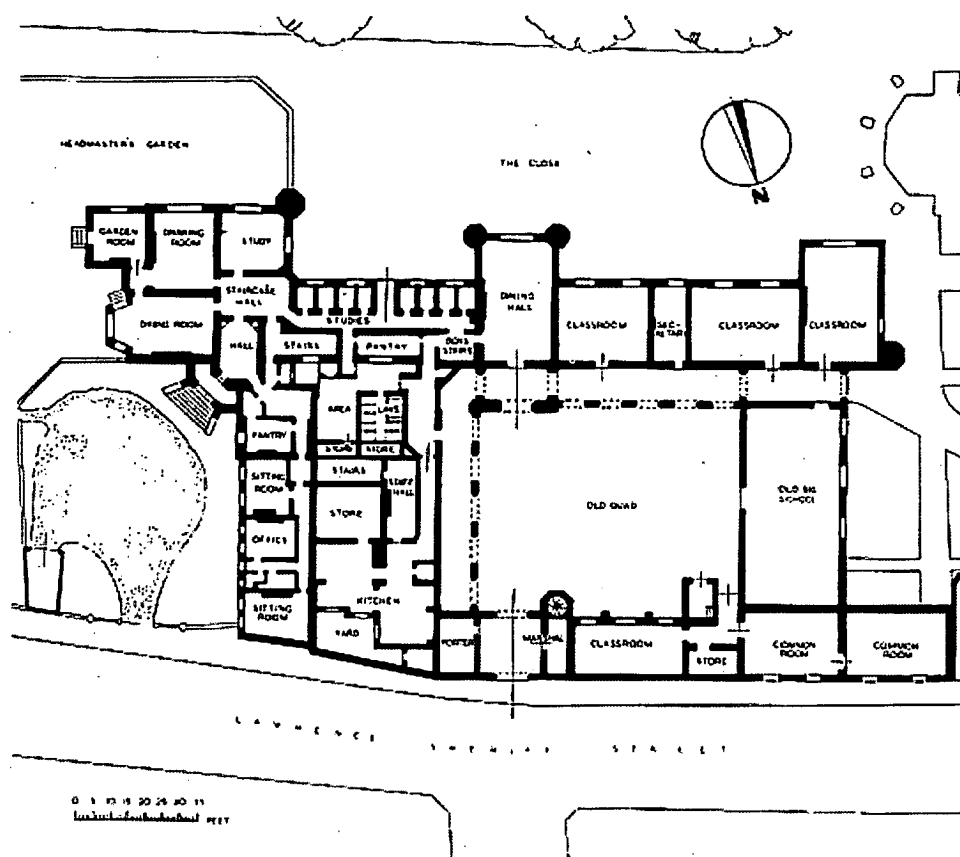


Figure B6: Rugby school, 1816. The ground floor plan shows some gardens on school grounds (Source: Seaborne, 1971, p.170)

APPENDIX C

A summary of four 20th century educators' and theorists' ideas which have influenced recent pedagogy compared with Malaysian practices.

Table C1: Comparisons of pedagogy in schools based on innovative Western education philosophies, compared with Malaysian practices

Criteria	Makarenko	Neill	Steiner	Montessori	Malaysian practices
Professionals background	Teacher	Teacher	Teacher	Teacher	Not applicable
Qualifications	Administrator in education office.	Child psychologist	Architect	Psychiatrist	Not applicable
Curriculum type	Basic survival skills	Self-directed learning	Anthrophosophy	Developmental	Highly structured teacher centred
Teaching approach	Group organised with strict rules.	Student centred.	Student centred	Student centred	Timetabled governed and regimented.
Discipline problems	Extensive from delinquency to criminal	At a peak until individuals change themselves	Minimal	Minimal	Minimal
Indoor teaching	Minimal	Academic subjects only.	Strong focus; art/craft using natural materials	Indoor equipment an important focus	All subjects except for Physical education.
Outdoor teaching	Emphasised	Emphasised	Strong emphasis on natural processes: seasons, life-cycle, gardening	Water play, sand play, gardening, art, science.	Physical education.

Table C2: Comparison of environmental demographics and design features of schools based on innovative Western education philosophies, compared with Malaysian practices

Criteria	Makarenko	Neill	Steiner	Montessori	Malaysian practices
Climate	Four seasons Tundra climate in Siberia.	Four seasons in England.	Varies. Schools located worldwide.	Varies. Schools located worldwide.	Tropical Malaysia.
Setting	Remote Village	Isolated in countryside.	Natural setting in a variety of environments	Universal with outdoor area	Universal
Ecological elements	Some incidental by the nature of place.	Free access to nature	Important but mostly philosophical.	Structured activity in outdoor environment	Little.
Building aesthetics	Not applicable.	Important.	Organic form and environmentally sustainable design approach	Emphasis on natural material/wood etc.	Standard building
Buildings safety – classrooms	Ad-hoc building adapted to school use. Self-policed safety.	Existing building adapted to school use safety is a major issue.	Proposed design building.	Proposed designed building.	Proposed designed building.
Landscaping	Farming environment.	English country gardens.	Varies from forest to urban environment.	Varies according to site	Minimal.

Table C3: Comparison of subjects studied in schools based on innovative Western education philosophies, compared with Malaysian practices

Criteria	Makarenko	Neill	Steiner	Montessori	Malaysian practices
Religious studies	None	None	Spiritual system based on Steiner's philosophy	None	Compulsory
Mathematics	Practice with villagers traders.	Through pocket money and in later years.	Concrete Operational	Mathematical principles discovered through equipment	Abstract
Science	Moderate	Moderate	Discovery based	Discovery based	Abstract
Geography	Moderate	Moderate	Moderate	Moderate	Rote learning
History	Moderate	Moderate	Mythology	Interest based	Rote learning
Art and Craft	Practical skills	Workshop based	Learning by making	Learning by making	Learning by making
Gardening	Compulsory subject.	Important.	Bio-dynamic	Important	Minimal
Learning tools and resources	Minimal	Moderate	Highly selected	Highly selected	Minimal
Foreign languages	None	Moderate	Moderate	Nil	English is compulsory
Sports and games	Annual events	Depends on students' needs.	Part of curriculum often with symbolic /ritual / overtones.	Depends on students' abilities.	Annual school sports.
Dancing, Drama and Music	Minimal	If wanted by students	Seasonal event	Encourage	Annual event

Table C4: Comparisons of social demographics in schools based on innovative Western education philosophies, compared to Malaysian practices

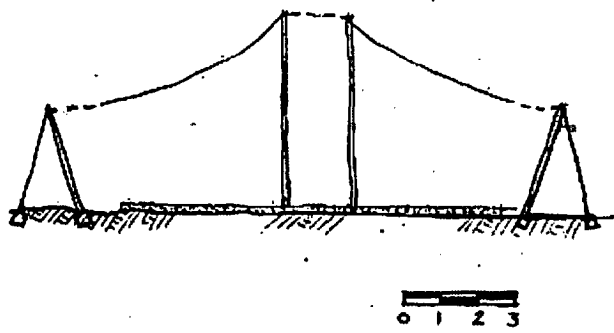
Criteria	Makarenko	Neill	Steiner	Montessori	Malaysian practices
Racial composition	Soviet nationalities.	International	Multi-racial	International	Multi-racial
Funding: Self or government	Group work generated half-funded by the government.	Totally self funded (fees).	Part funded by the government and parents (fees).	Part funded by the government and parents (fees).	Totally funded by the government apart from private schools.
Middle class economic and social background of students	Juvenile delinquents.	Middle class behaviour problems.	Mostly middle class and some from rich families.	Mixed background depending on location of school.	Mixed background depending on location of school.

APPENDIX D

COSTING AND STRUCTURAL STUDIES

Below are costings for open air-classrooms constructed from different building materials, based on a 10 metre x 10 metre structure for a standard classroom, without services costs. Costs are compared with current classroom construction costs and types of materials used (RM 450.00/m square = RM 45,000).

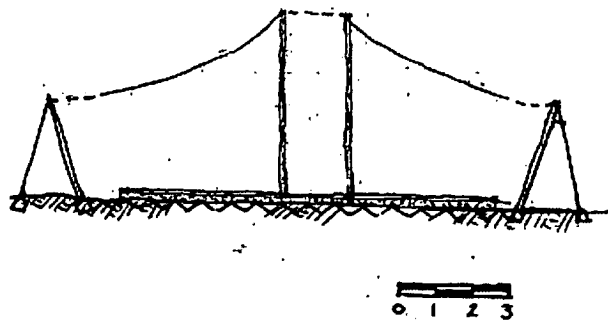
(NB. The exchange rate is calculated at RM 2.00 to AUD1.00, current at the time of printing)



Proposed outdoor classroom (Type 1) using:

- Tensile structure and gravel paving;
- Spending: 56.55% more, compared to existing structure

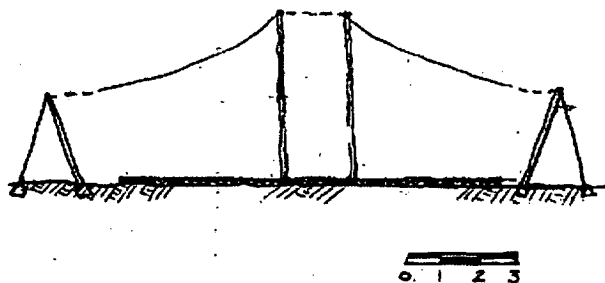
Tensile structure at RM 700/m square	70,000
Gravel paving at RM 4.50/m square	450
	RM 70,450



Proposed outdoor classroom (Type 2) using:

- Tensile structure and broom finish;
- Spending: 59.55% more, compared to existing structure

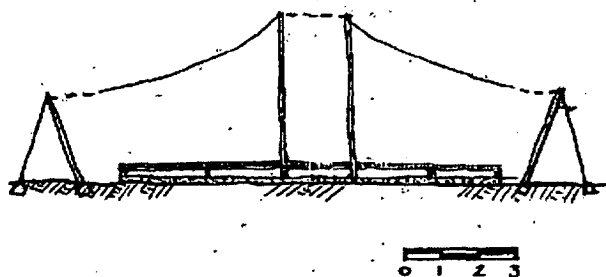
Tensile structure at RM 700/m square	70,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 71,800



Proposed outdoor classroom (Type 3) using:

- Tensile structure and brick paving, dry laid;
- Spending: 59.55% more, compared to existing structure

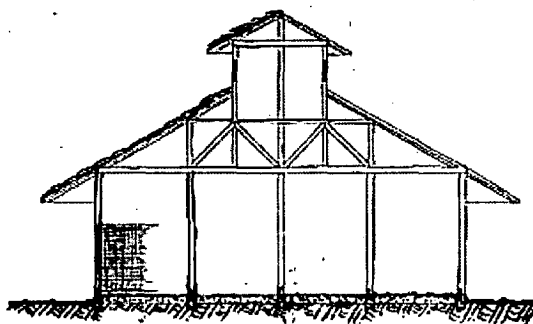
Tensile structure at RM 700/m square	70,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 71,800



Proposed outdoor classroom (Type 4) using:

- Tensile structure and timber decking;
- Spending: 82.22% more, compared to existing structure

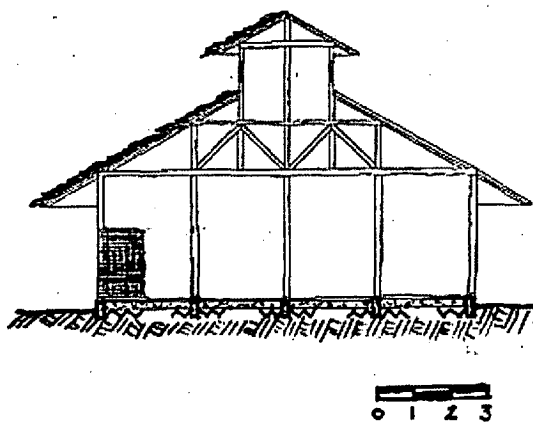
Tensile structure at RM 700/m square	70,000
Timber decking at RM 120/m square	12,000
	RM 82,000



Proposed outdoor classroom (Type 5) using:

- Timber structure, palm thatch and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving; 80.6%, compared to existing structure

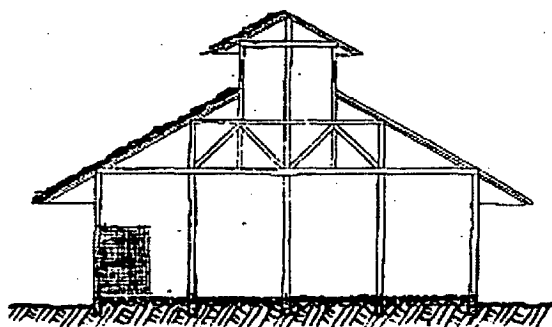
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Woven bamboo screens at RM 5/m square	500
Gravel paving at RM 4.50/m square	450
	RM 8,700



Proposed outdoor classroom (Type 6) using:

- Timber structure, palm thatch and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 76.55%, compared to existing structure

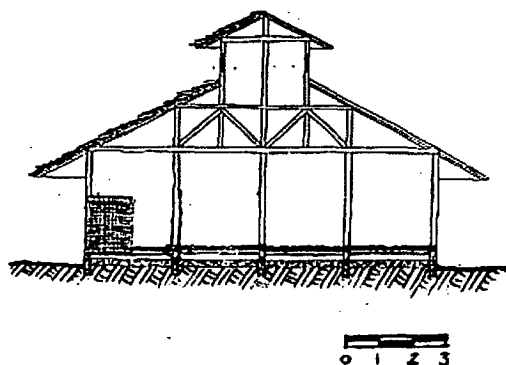
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Woven bamboo screens at RM 5/m square	500
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 10,550



Proposed outdoor classroom (Type 7) using:

- Timber structure, palm thatch and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 76.55%, compared to existing structure

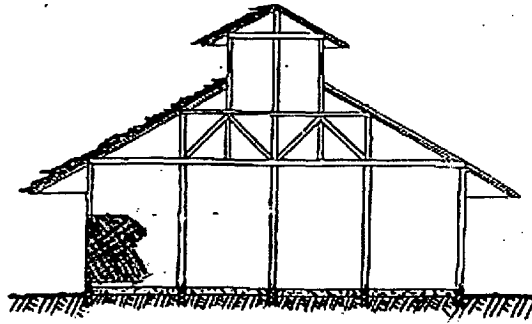
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Woven bamboo screens at RM 5/m square	500
Brick paving, dry laid at RM 18/m square	1,800
	RM 10,550



Proposed outdoor classroom (Type 8) using:

- Timber structure, palm thatch and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 53.8%, compared to existing structure

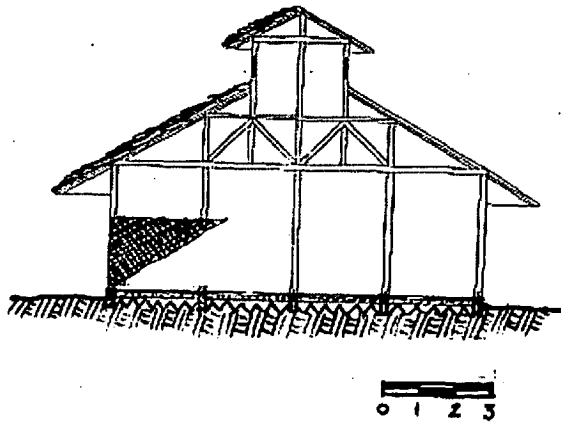
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Woven bamboo screens at RM 5/m square	500
Timber decking at RM 120/m square	12,000
	RM 20,750



Proposed outdoor classroom (Type 9) using:

- Timber structure, palm thatch and timber lattice;
- (Type 'A' hardwood timber: ~ 100-year life span);
- Saving: 69.55%, compared to existing structure

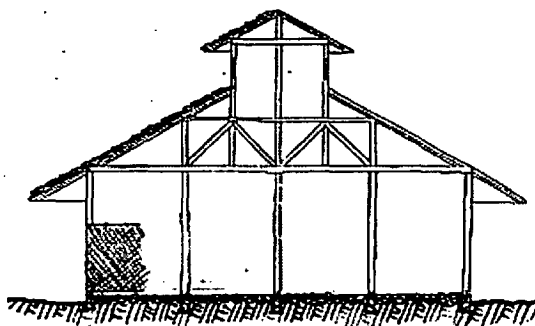
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Timber lattice at RM 50/m square	5,000
Gravel paving at RM 4.50/m square	450
	RM 13,700



Proposed outdoor classroom (Type 10) using:

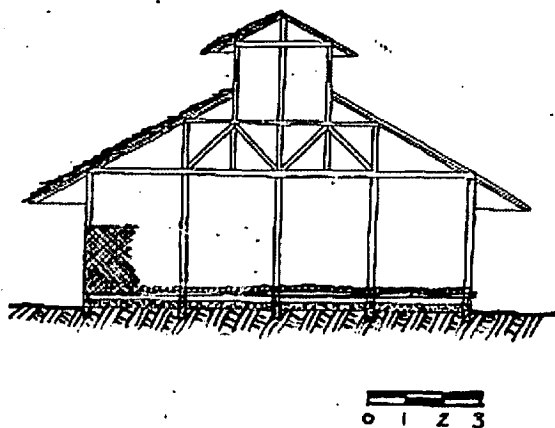
- Timber structure, palm thatch and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 66.55%, compared to existing structure

Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Timber lattice at RM 50/m square	5,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 15,050

**Proposed outdoor classroom (Type 11) using:**

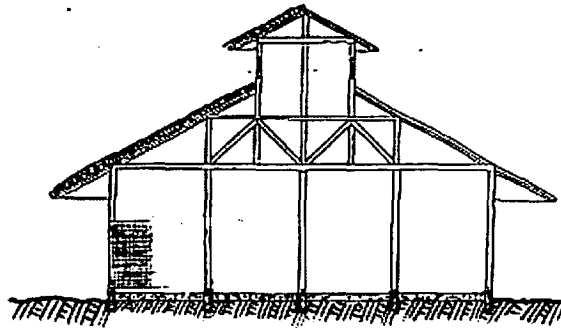
- Timber structure, palm thatch and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 66.55%, compared to existing structure

Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Timber lattice at RM 50/m square	5,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 15,050

**Proposed outdoor classroom (Type 12) using:**

- Timber structure, palm thatch and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 43.88%, compared to existing structure

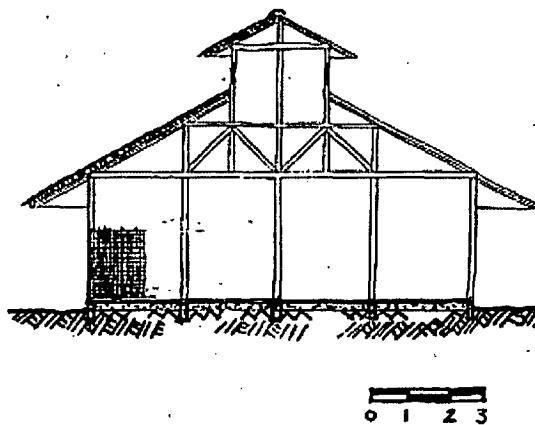
Timber structure at RM 75/m square	7,500
Palm thatch at RM 7.50/m square	750
Timber lattice at RM 50/m square	5,000
Timber decking at RM 120/m square	12,000
	RM 25,250



Proposed outdoor classroom (Type 13) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 72.33%, compared to existing structure

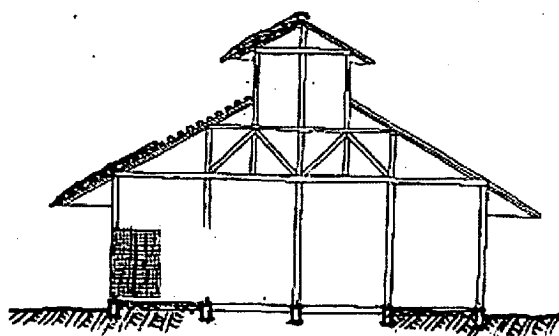
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Woven bamboo screens at RM 5/m square	500
Gravel paving at RM 4.50/m square	450
	RM 12,450



Proposed outdoor classroom (Type 14) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 69.33%, compared to existing structure

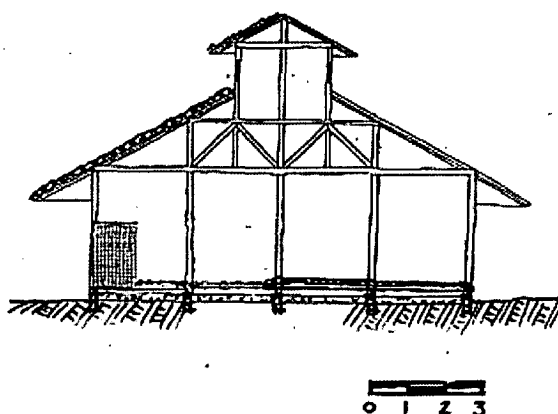
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Woven bamboo screens at RM 5/m square	500
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 13,800



Proposed outdoor classroom (Type 15) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 69.33%, compared to existing structure

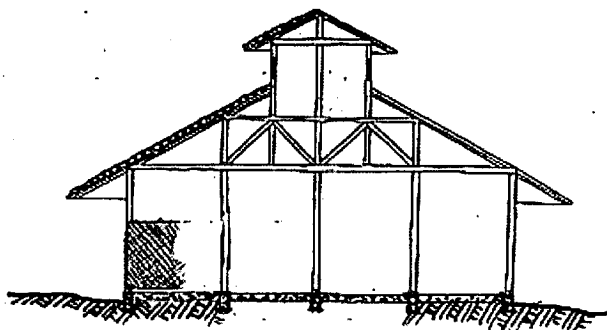
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Woven bamboo screens at RM 5/m square	500
Brick paving, dry laid at RM 18/m square	1,800
	RM 13,800



Proposed outdoor classroom (Type 16) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 46.66%, compared to existing structure

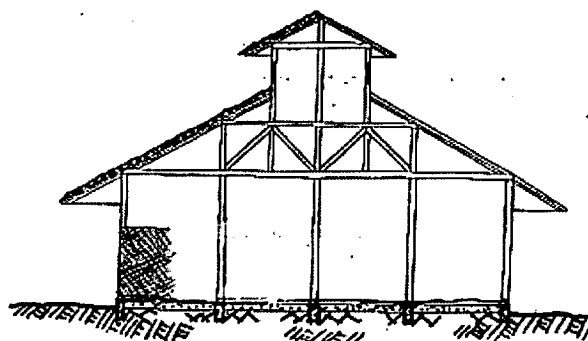
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Woven bamboo screens at RM 5/m square	500
Timber decking at RM 120/m square	12,000
	RM 24,000



Proposed outdoor classroom (Type 17) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 62.33%, compared to existing structure

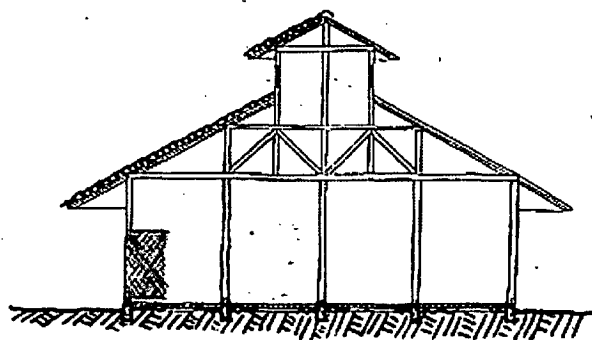
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Timber lattice at RM 50/m square	5,000
Gravel paving at RM 4.50/m square	450
	RM 16,950



Proposed outdoor classroom (Type 18) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 59.33%, compared to existing structure

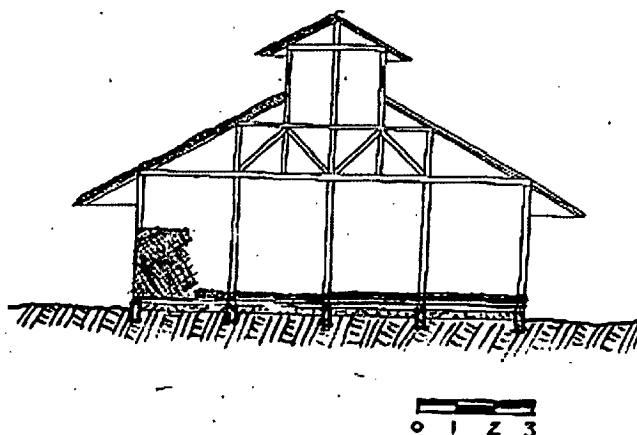
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m square	4,000
Timber lattice at RM 50/m square	5,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 18,300



Proposed outdoor classroom (Type 19) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 59.33%, compared to existing structure

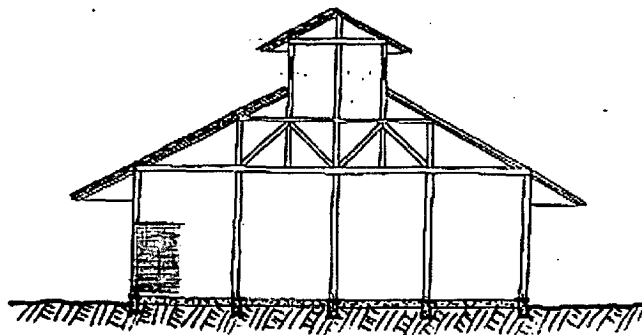
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m	4,000
Timber lattice at RM 50/m square	5,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 18,300



Proposed outdoor classroom (Type 20) using:

- Timber structure, tile (clay or concrete) roof on timber trusses and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 36.66%, compared to existing structure

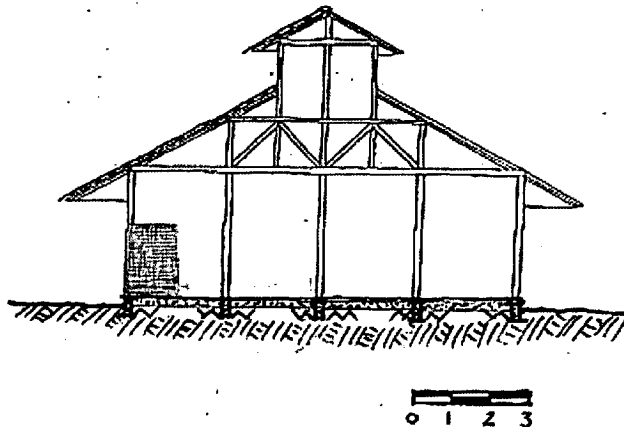
Timber structure at RM 75/m square	7,500
Tile (clay or concrete) roof on timber trusses at RM 40/m	4,000
Timber lattice at RM 50/m square	5,000
Timber decking at RM 120/m square	12,000
	RM 28,500



Proposed outdoor classroom (Type 21) using:

- Timber structure, insulated iron roof with timber lining and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 76.77%, compared to existing structure

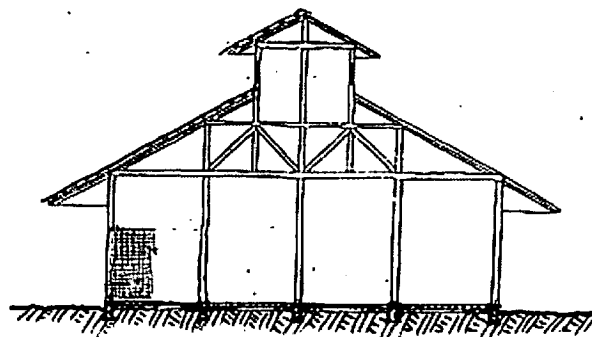
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Woven bamboo screens at RM 5/m square	500
Gravel paving at RM 4.50/m square	450
	RM 10,450



Proposed outdoor classroom (Type 22) using:

- Timber structure, insulated iron roof with timber lining and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 73.77%, compared to existing structure

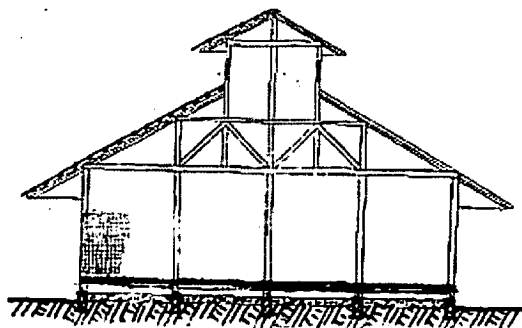
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Woven bamboo screens at RM 5/m square	500
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 11,800



Proposed outdoor classroom (Type 23) using:

- Timber structure, insulated iron roof with timber lining and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 73.77%, compared to existing structure

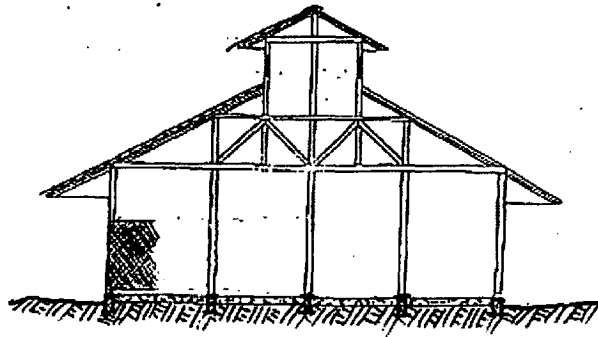
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Woven bamboo screens at RM 5/m square	500
Brick paving, dry laid at RM 18/m square	1,800
	RM 11,800



Proposed outdoor classroom (Type 24) using:

- Timber structure, insulated iron roof with timber lining and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 51.11%, compared to existing structure

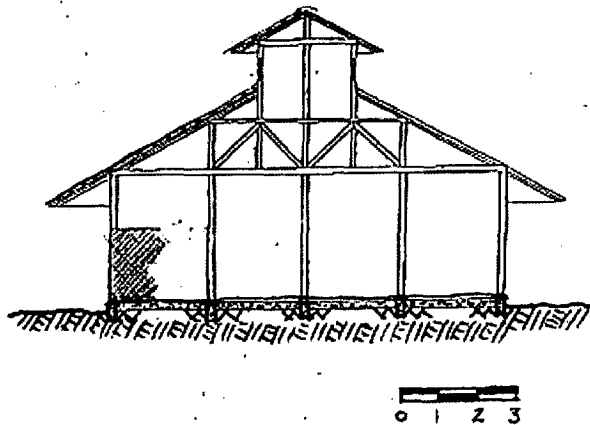
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Woven bamboo screens at RM 5/m square	500
Timber decking at RM 120/m square	12,000
	RM 22,000



Proposed outdoor classroom (Type 25) using:

- Timber structure, insulated iron roof with timber lining and timber lattice screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 66.77%, compared to existing structure

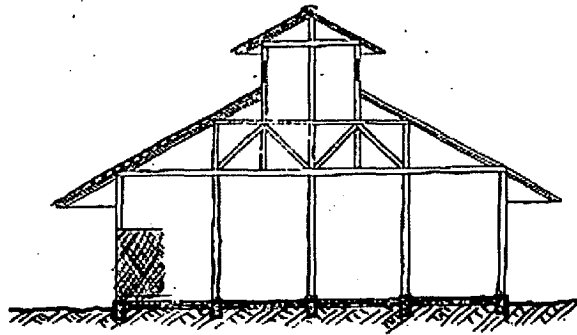
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Timber lattice at RM 50/m square	5,000
Gravel paving at RM 4.50/m square	450
	RM 14,950



Proposed outdoor classroom (Type 26) using:

- Timber structure, insulated iron roof with timber lining and timber lattice screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 63.77%, compared to existing structure

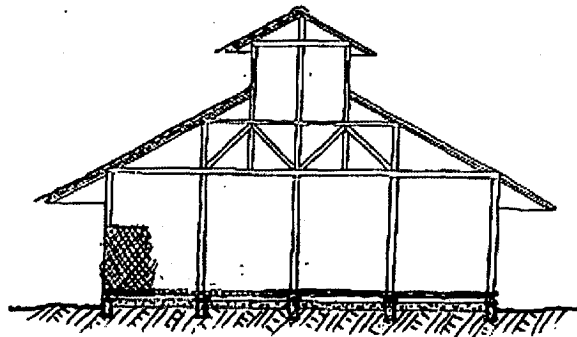
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Timber lattice at RM 50/m square	5,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 16,300



Proposed outdoor classroom (Type 27) using:

- Timber structure, insulated iron roof with timber lining and timber lattice screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 63.77%, compared to existing structure

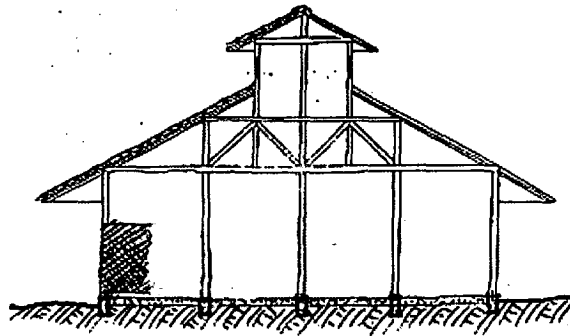
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Timber lattice at RM 50/m square	5,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 16,300



Proposed outdoor classroom (Type 28) using:

- Timber structure, insulated iron roof with timber lining and timber lattice screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 41.11%, compared to existing structure

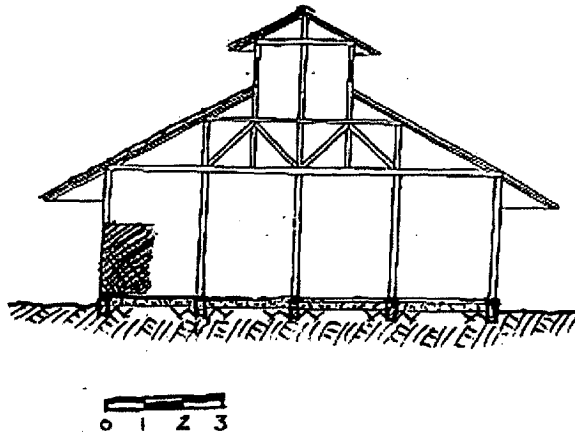
Timber structure at RM 75/m square	7,500
Insulated iron roof with timber lining at RM 20/m square	2,000
Timber lattice at RM 50/m square	5,000
Timber decking at RM 120/m square	12,000
	RM 26,500



Proposed outdoor classroom (Type 29) using:

- Timber structure, corrugated iron and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 70.9%, compared to existing structure

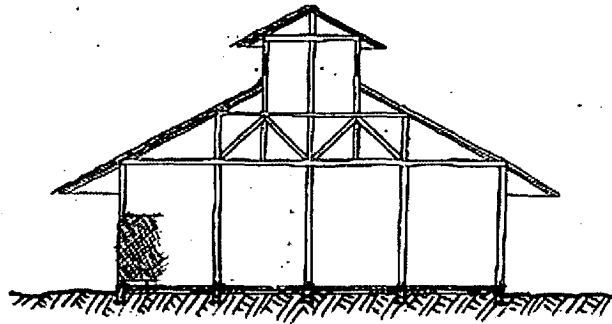
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Timber lattice at RM 50/m square	5,000
Gravel paving at RM 4.50/m square	450
	RM 13,080



Proposed outdoor classroom (Type 30) using:

- Timber structure, corrugated iron plain and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 67.9%, compared to existing structure

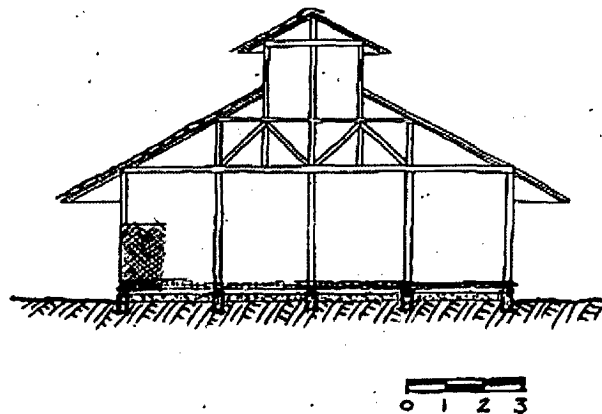
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Timber lattice at RM 50/m square	5,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 14,430



Proposed outdoor classroom (Type 31) using:

- Timber structure, corrugated iron plain and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 67.9%, compared to existing structure

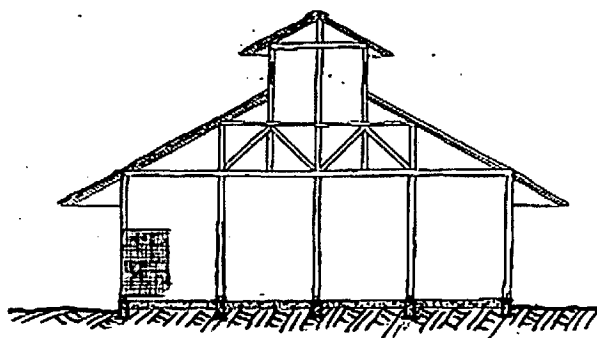
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Timber lattice at RM 50/m square	5,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 14,430



Proposed outdoor classroom (Type 32) using:

- Timber structure, corrugated iron plain and timber lattice;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: exactly 45.26%, compared to existing structure

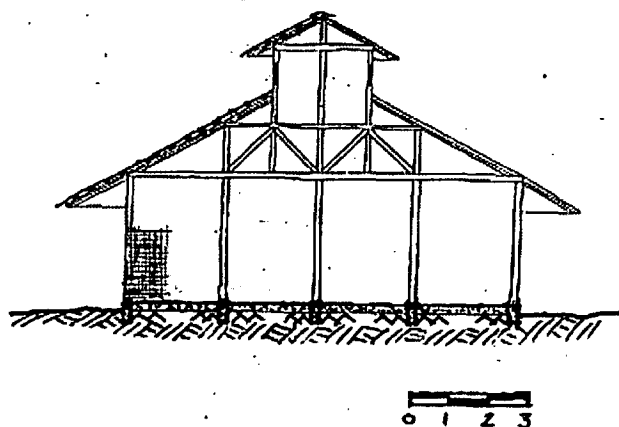
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Timber lattice at RM 50/m square	5,000
Timber decking at RM 120/m square	12,000
	RM 24,630



Proposed outdoor classroom (Type 33) using:

- Timber structure, corrugated iron plain and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 80.93%, compared to existing structure

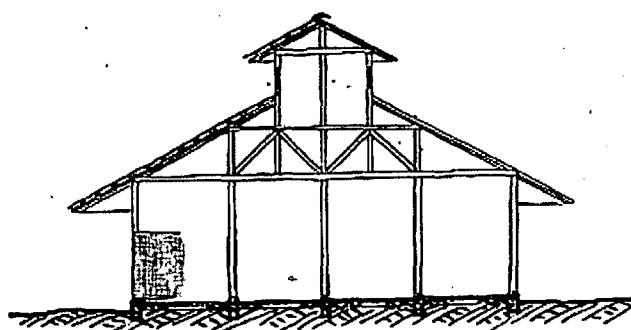
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Woven bamboo screens at RM 5/m square	500
Gravel paving at RM 4.50/m square	450
	RM 8,580



Proposed outdoor classroom (Type 34) using:

- Timber structure, corrugated iron plain and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 77.93%, compared to existing structure

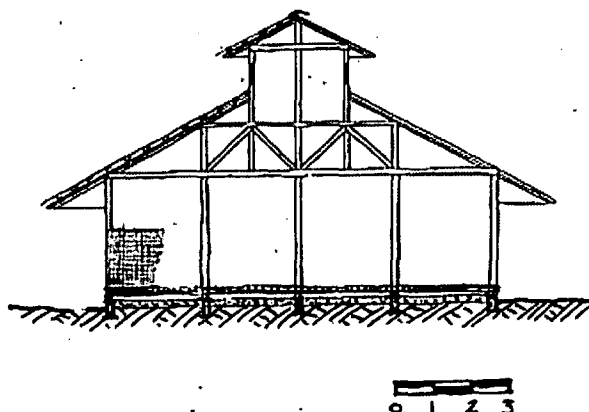
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Woven bamboo screens at RM 5/m square	500
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 9,930



Proposed outdoor classroom (Type 35) using:

- Timber structure, corrugated iron plain and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 77.93%, compared to existing structure

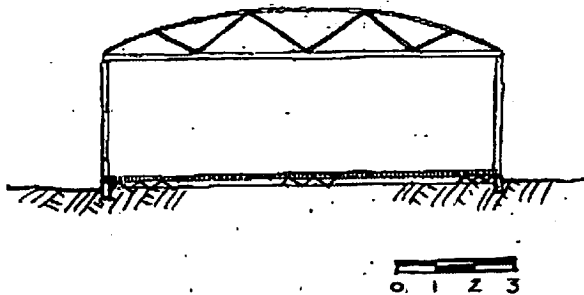
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Woven bamboo screens at RM 5/m square	500
<u>Brick paving, dry laid at RM 18/m</u>	<u>1,800</u>
	RM 9,930



Proposed outdoor classroom (Type 36) using:

- Timber structure, corrugated iron plain and woven bamboo screens;
- (Type 'A' hardwood timber: ~ 100 year life span);
- Saving: 55.26%, compared to existing structure

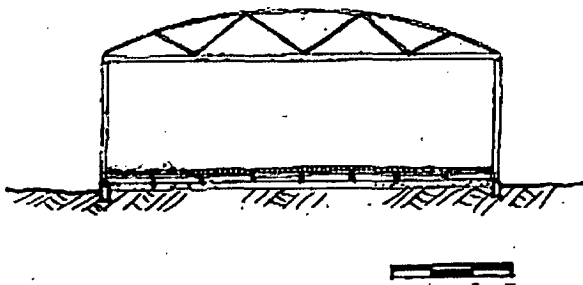
Timber structure at RM 75/m square	7,500
Corrugated iron plain at RM 1.30/m square	130
Woven bamboo screens at RM 5/m square	500
<u>Timber decking at RM 120/m square</u>	<u>12,000</u>
	RM 20,130



Proposed outdoor classroom (Type 37) using:

- Barrel vault membrane and truss structure with timber decking;
- Saving: 57.77%, compared to existing structure

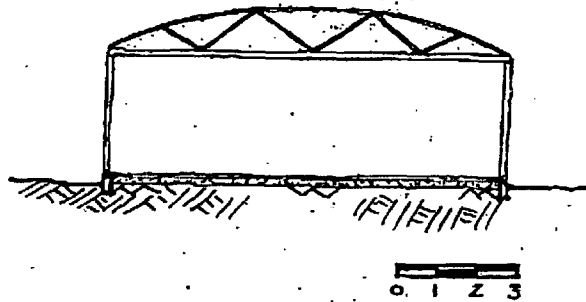
Barrel vault membrane and truss structure at RM 70/m square	7,000
Timber decking at RM 120/m square	12,000
	RM 19,000



Proposed outdoor classroom (Type 38) using:

- Barrel vault membrane and truss structure with brick paving, dry laid;
- Saving: exactly 80.44%, compared to existing structure

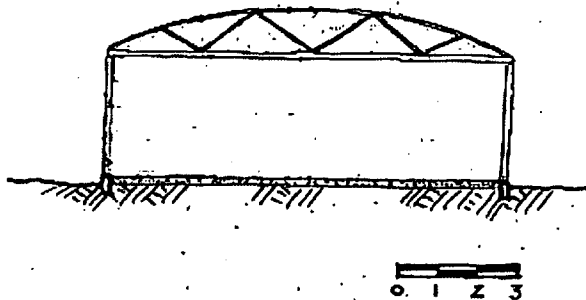
Barrel vault membrane and truss structure at RM 70/m square	7,000
Brick paving, dry laid at RM 18/m square	1,800
	RM 8,800



Proposed outdoor classroom (Type 39) using:

- Barrel vault membrane and truss structure with broom finished concrete floor;
- Saving: 80.44%, compared to existing structure

Barrel vault membrane and truss structure at RM 70/m square	7,000
Broom finished concrete floor grade 30 at RM 18/m square	1,800
	RM 8,800



Proposed outdoor classroom (Type 40) using:

- Barrel vault membrane and truss structure with gravel paving;
- Saving: 83.44%, compared to existing structure

Barrel vault membrane and truss structure at RM 70/m square	7,000
Gravel paving at RM 4.50/m square	450
	RM 7,450

Verified and checked by Mr. Abd. Mizan Abd. Majid, on behalf of registered Quantity Surveyor Practitioner Mrs. Wan Rodiah Wan Mahmud, Professional QS registration number 103 and Structural engineer Ir. Meor Azizudin Meor Hashim, Registration Number 1496.

APPENDIX E

SUITABLE VEGETATION FOR SCHOOLS: ANOTHER FACTOR INFLUENCING CLIMATIC COOLING - Adapted from Harris (1997).

Recommended species, based on their uses in different outdoor classroom types and spaces.

Trees

Selection is based on safety (non-poisonous), suitability (shade) and rapid rate of growth.

<i>Azadirachta excelsa</i>	<i>Casuarina equisetifolia</i>
<i>Casuarina nobilis</i>	<i>Cinnamomum iners</i>
<i>Ficus benjamina</i>	<i>Erythrina variegata</i>
<i>Erythrina glauca</i>	<i>Eugenia grandis</i>
<i>Hibiscus tiliaceus</i>	<i>Lagerstroemia floribunda</i>
<i>Muntingia calabura</i>	<i>Pongamia pinnata</i>
<i>Tectona grandis</i>	<i>Peltophorum pterocarpum</i>
<i>Hopea odorata</i>	<i>Juniperus chinensis</i>
<i>Tabebuia speciosa</i>	<i>Sterculia rubiginosa</i>

Shrubs

Selection is based on safety (non-poisonous), suitability (hardy and hedge-like) and rapid rate of growth.

<i>Rhododendron spp.</i>	<i>Acalypha hispida</i>	<i>Catharantus roseus</i>
<i>Acalypha wilkesiana</i>	<i>Bixa orellana</i>	<i>Ixora coccinea</i>
<i>Codiaeum variegatum</i>	<i>Duranta repens</i>	<i>Vinca major</i>
<i>Hibiscus rosa-sinensis</i>	<i>Lagerstroemia indica</i>	<i>Bougainvillea spp.</i>

Palms

Selection is based on safety (non-poisonous), suitability (hardy and hedge-like) and rapid rate of growth.

<i>Areca catechu</i>	<i>Chrysalidocarpus lutescens</i>
<i>Cocos nucifera</i>	<i>Rhapis excelsa</i>
<i>Veitchia merillii</i>	<i>Roystonea regia</i>

Turfing or grasses

Selection is based on low maintenance and hardiness.

Axonopus compressus – (cow grass)

.....Types of vegetation suitable for school grounds and its characteristics

Botanical name	Common name	Stratification	Character	Size	Boundaries	Woodland	Open parkland	Shady	Buffer or screening	Stream or water edge	Wildlife refuge
<i>Andira inermis</i>	Cabbage tree	Lower storey	Upright, dense form, textured foliage	S	Y		Y	Y			
<i>Cananga odorata</i>	<i>Kenanga</i>	Middle storey	Evergreen tree, drooping appearance, sweet smelling flowers	S	Y		Y				Y
<i>Samanea saman</i>	Rain trees	Upper storey	Umbrella shaped, light foliage, fast growing, good shape	L	Y	Y	Y		Y		Y
<i>Delonix regia</i>	Flame of the Forest	Upper storey	Umbrella shaped and light foliage	M	Y	Y	Y	Y	Y		Y

Botanical name	Common name	Stratification	Character	Size	Boundaries	Woodland	Open parkland	Shady	Buffer or screening	Stream or water edge	Wildlife refuge
<i>Filicium decipiens</i>	Fern tree	Lower storey	Dense round headed with dark green foliage and shady tree	S	Y	Y	Y				
<i>Lagerstoemia speciosa</i>	Bungor	Middle storey	Good shade tree, attractive flowers-cluster and round head	M	Y	Y	Y	Y			
<i>Gardenia carinata</i>	Cempaka hutan	Lower storey	A small spreading tree with rich yellow flowers and fragrant.	S	Y	Y	Y				Y

Appendix E

Botanical name	Common name	Stratification	Character	Size	Boundaries	Woodland	Open parkland	Shady	Buffer or screening	Stream or water edge	Wildlife refuge
<i>Castanopsis inermis</i>	<i>Berangan</i>	Upper storey	Silvery leaves beneath knobbly edible fruits	L		Y			Y		Y
<i>Manilkara zapota</i>	<i>Ciku</i>	Lower storey	Evergreen deciduous tropical tree with dense crown and good shade	S		Y	Y	Y			
<i>Mangifera indica</i>	<i>Mango</i>	Middle storey	Crown massive, roundish unbuttressed	M		Y	Y	Y			Y
<i>Garcinia mangostana</i>	<i>Mangosteen</i>	Middle storey	Evergreen, gives deep shade dense crown	M		Y		Y	Y		Y
<i>Nephelium lappaceum</i>	<i>Rambutan</i>	Middle storey	Good shade and screen tree	M		Y		Y	Y		Y
<i>Artocarpus incisus</i>	<i>Sukun</i>	Middle storey	Very dark shiny green deeply lobed leaves	M		Y	Y		Y		Y
<i>Tamarindus indica</i>	<i>Assam jawa</i>	Middle storey	Dense rounded crown	L	Y	Y	Y	Y	Y		Y

Botanical name	Common name	Stratification	Character	Size	Boundaries	Woodland	Open parkland	Shady	Buffer or screening	Stream or water edge	Wildlife refuge
<i>Michelia alba</i>	<i>Cempaka putih</i>	Middle storey	Large light green leaves, good shade and exceptional fragrance	M	Y	Y	Y	Y	Y		
<i>Mimusops elengi</i>	<i>Tanjung</i>	Lower storey	Dense and bushy tree, round headed	S	Y	Y	Y		Y		Y
<i>Casuarina sumatrana</i>	<i>Ru sumatrana</i>	Middle storey	Formal conical shape	M	Y		Y				
<i>Artocarpus heterophyllus</i>	<i>Jack fruit</i>	Middle storey	Evergreen with dark green leaves	M		Y	Y				Y
<i>Cassia fistula</i>	<i>Golden shower</i>	Lower storey	Broad headed spectacular flowers	S	Y	Y	Y	Y			
<i>Parkia speciosa</i>	<i>Petai</i>	Upper climax	Tall with large feathery leaves and umbrella shaped, tropical deciduous	L	Y	Y	Y				Y

Botanical name	Common name	Stratification	Character	Size	Boundaries	Woodland	Open parkland	Shady	Buffer or screening	Stream or water edge	Wildlife refuge
<i>Onchosperma tigillarum</i>	<i>Nibong</i>		Very large many stemmed palm with feathery fronds.	L		Y			Y	Y	Y
<i>Salix babylonica</i>	<i>Weeping widow</i>	Lower storey	Small tree light green crown slender drooping	S	Y	Y	Y	Y	Y		Y
<i>Cocos nucifera</i>	<i>Coconut tree</i>	Lower storey	Tall palm, large feathery crown	M	Y	Y	Y	Y	Y	Y	Y
<i>Cinnamomum iners</i>	<i>Kayu manis</i>	Lower storey	Dense, bushy and round headed	S		Y	Y				
<i>Anacardium occidentale</i>	<i>Cashew nut</i>	Lower storey	Open crowned spreading leaves	M		Y		Y			Y
<i>Artocarpus interger</i>	<i>Chempedak</i>	Middle storey	Evergreen with dark green leaves	L		Y					Y
<i>Averhoa carambola</i>	<i>Belimbing besi</i>	Middle storey	Small profusely branched shady crown, juicy fruits	M		Y	Y		Y		Y

APPENDIX F

WILDLIFE ATTRACTED TO PLANTS SUITABLE FOR SCHOOL

GROUND - Adapted from Harris (1997).

Wildlife species suitable for school grounds are birds, butterflies, moths, insects, and vertebrates and include:

<i>Latin name</i>	<i>Common Name</i>	<i>Latin name</i>	<i>Common Name</i>
<i>Rhizothera longirostris</i>	Long-billed Partridge	<i>Melanoperdix nigra</i>	Black Partridge
<i>Coturnix chinensis</i>	Blue-breasted Quail	<i>Arborophila charltonii</i>	Chestnut-necklaced Partridge
<i>Caloperdix ocella</i>	Ferruginous partridge	<i>Rollulus rouloul</i>	Crested Partridge
<i>Gallus gallus</i>	Red Junglefowl	<i>Lophura erythrophthalma</i>	Crestless Fireback
<i>Lophura ignita</i>	Crested Fireback	<i>Polyplectron inopinatum</i>	Mountain Peacock-Pheasant
<i>Polyplectron malacense</i>	Malayan Peacock-Pheasant	<i>Rheinardia ocellata</i>	Crested Argus
<i>Argusianus argus</i>	Great Argus	<i>Dendrocygna javanica</i>	Lesser Whistling-Duck
<i>Cairina scutulata</i>	White-winged Duck	<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose
<i>Anas penelope</i>	Eurasian Wigeon	<i>Anas clypeata</i>	Northern Shoveler
<i>Anas acuta</i>	Northern Pintail	<i>Anas querquedula</i>	Garganey
<i>Anas crecca</i>	Common Teal	<i>Aythya fuligula</i>	Tufted Duck
<i>Turnix suscitator</i>	Barred Buttonquail	<i>Indicator archipelagicus</i>	Malaysian Honeyguide
<i>Picumnus innominatus</i>	Speckled Piculet	<i>Sasia abnormis</i>	Rufous Piculet
<i>Sasia ochracea</i>	White-browed Piculet	<i>Dendrocopos moluccensis</i>	Sunda or Brown-capped Woodpecker
<i>Dendrocopos canicapillus</i>	Grey – capped Woodpecker	<i>Celeus brachyurus</i>	Rufous Woodpecker
<i>Dryocopus javensis</i>	White-bellied Woodpecker	<i>Picus mineaceus</i>	Banded Woodpecker
<i>Picus chlorolophus</i>	Lesser Yellownape	<i>Picus puniceus</i>	Crimson-winged Woodpecker
<i>Picus flavinucha</i>	Greater Yellownape	<i>Picus mentalis</i>	Checker-throated Woodpecker
<i>Picus viridanus</i>	Streak-breasted Woodpecker	<i>Picus vittatus</i>	Laced Woodpecker
<i>Picus canus</i>	Grey-faced or headed Woodpecker	<i>Dinopium rafflesii</i>	Olive-backed Woodpecker
<i>Dinopium javanense</i>	Common Flameback or Goldenback	<i>Chrysocolaptes lucidus</i>	Greater Flameback
<i>Gecinulus viridis</i>	Bamboo Woodpecker	<i>Blythipicus rubiginosus</i>	Marron Woodpecker
<i>Blythipicus pyrrhotis</i>	Bay Woodpecker	<i>Reinwardtipicus validus</i>	Orange-backed Woodpecker
<i>Meiglyptes tristis</i>	Buff-rumped Woodpecker	<i>Meiglyptes tukki</i>	Buff-necked Woodpecker
<i>Hemicircus concretus</i>	Grey-and buff Woodpecker	<i>Mulleripicus pulverulentus</i>	Great Slaty Woodpecker
<i>Psilopogon pyrolophus</i>	Fire-tufted Barbet	<i>Megalaima lineata</i>	Lineated Barbet
<i>Megalaima chrysopogon</i>	Gold-whiskered Barbet	<i>Megalaima rafflesii</i>	Red-crowned Barbet
<i>Megalaima mystacophanos</i>	Red-throated Barbet	<i>Megalaima franklinii</i>	Golden-throated Barbet
<i>Megalaima oorti</i>	Black-browed Barbet/Muller's Barbet/Chinese Barbet	<i>Megalaima henricii</i>	Yellow-crowned Barbet
<i>Megalaima australis</i>	Blue-eared Barbet	<i>Megalaima haemacephala</i>	Coppersmith Barbet

Bird species for forest / woodland sites

Babblers	Barbets	Woodpeckers	Spiderhunters
Birds of Prey	Owl	White-eye	Cuckoo-shrikes
Egrets	Bee-eaters	Crows	Herons
Kingfishers	Flower-peckers	Flycatchers	Waders
Storks	Pigeons	Swallow	Sunbirds

Butterfly species suitable for school grounds

Family : Papilionidae Sub family : Papilioninae (12 species)	Family : Pieridae Sub family : Pierinae (3 species)
Family : Nymphalidae Sub family : Danainae (14 species) Sub family : Morphinae (4 species) Sub family : Charaxinae (1 species)	Family : Lycaenidae Sub family : Riodininae (3 species) Sub family : Miletinae (4 species) Sub family : Lycaeninae (39 species)
Family : Hesperidae Sub family : Coeliadinae (2 species) Sub family : Hesperinae (16 species)	

APPENDIX G

MALAY, IBAN AND MANDARIN IDIOMS RELATED TO THE ENVIRONMENT

MALAY IDIOMS RELATED TO THE ENVIRONMENT

seperti aur dengan tebing: observe how the bamboo shoot and the riverbank are interdependent (working together)

berat sama dipikul, ringan sama dijinjing: if you carry something on your shoulders it feels heavy, if you carry it with someone else, it feels lighter (cooperation, group work)

tiada beban batu di galas: when there is no problem, one carries rock (don't look for problems that aren't really there)

mendengar guruh air tempayan dicurah: if you hear thunder, empty the water barrel (confirm the news first, before believing it)

bapa borek anak rintik: like father, like son

membuka pekong di dada: opening an old wound (hang out your dirty washing)

di mana bumi di pijak di situ langit di junjung: where one stands, that is where the sky is (be aware of the different customs wherever you are)

tiada angin pokok tak bergoyang: without wind, a tree would not shake (where there is smoke there is fire)

sesat di hujung jalan, balik ke pangkal jalan: If you lose your way in the middle of the road, go back to the beginning

IBAN INDIGENOUS IDIOMS RELATED TO THE ENVIRONMENT IN LANGUAGE SUBJECT

Agi idup agi ngalaban: to sacrifice as long as you live.

MANDARIN IDIOMS RELATED TO ENVIRONMENT IN LANGUAGE SUBJECT

ru ying sui xing: inseparable as each other's shadows (similar pair)

yuan mu qin yu: climbing a tree to seek for fish (you're not looking at the right direction)

du ri ru nian: each day passes like a year (a very difficult time to pass each day)

fu zhong you yi: fish swimming in a cauldron (limited space and experience)

jia ji shui ji: marry a chicken, follow a chicken (commit to certain family or situation you are obligated to follow all the way)

zhong gua de gua: you plant melons, you reap melons (you reap what you sow)

yin shui si yuan: while drinking water, remember the source (to be grateful and remember the benefactor)

wu feng qi leng: creating waves without wind (problems caused by other sources)

jin zhu zhe chi, jin mo zhe hei: near vermilion one gets stained red, near ink, one gets stained black (how others can influence one)

luo ye gui gen: falling leaves return to their roots (circle of life)

piao: gone with the wind (super fast)

APPENDIX H

INFORMATION SHEETS, CONSENT SHEET, AND QUESTIONNAIRE

INFORMATION SHEET FOR HEADMASTER / MISTRESS. A STUDY OF OUTDOOR EDUCATION FOR PRIMARY SCHOOLS IN MALAYSIA

My name is Miss Maheran Yaman and I am a Ph.D student in the School of Architecture at the University of Tasmania, Australia. My Principal Supervisor is Dr. Andras Kelly from the School of Architecture and my Co-Supervisor is Dr. Margaret Robertson from the Faculty of Education, University of Tasmania. Dr. Andras Kelly is the Chief Investigator of this project. The aim of my research is to investigate the potential use of outdoor spaces for teaching.

This study explores the possible benefits of outdoor learning in primary schools in Malaysia. The thesis background is based on the hypothesis that the use of outdoor classrooms in primary education in Malaysia could bring significant teaching and learning opportunities, as well as environmental, social and economic benefits. This thesis is in line with the intentions of the 2001 Malaysian Minister of Education budget report proposal to budget for significantly more money to be spent on education.

We are inviting teachers from urban, suburban and rural government primary schools and other stakeholders involved in primary school education and professionals involved in primary school design in Malaysia, to participate in this study and would value your contribution to it.

No payment will be made for your participation in this study.

No risks or discomfort are anticipated. However, should you experience any discomfort, you may withdraw from the participation at any time, without prejudice.

If you agree to take part, you will be provided with a questionnaire to complete. It will take approximately thirty minutes. The Headmaster/mistress will give the questionnaire to the teachers. Upon completing the questionnaire, a short group discussion will be conducted with the teachers involved for thirty minutes.

Names or other identifying information are not required so your anonymity is assured. Careful treatment will be given to ensure that there is no specific information that could be used to identify people and schools mentioned in the study. Coding will be used to refer to the subjects, particularly schools and participants. All data and information will be stored securely in a locked filing cabinet in the School of Architecture and kept confidential. Access to the information, including documents gathered, notes and transcripts will be controlled and used to construct the final report. Data will be retained for five years and then shredded. This project has received ethics approval from the Southern Tasmania Human Research Ethics Committee and the school Headmaster/mistress.

If you have any concerns of an ethical nature or complaints about the manner in which the project is conducted you may contact the Chair or Executive Officer of the Southern Tasmania Social Sciences Human Research Ethics Committee.

The Chair of Southern Tasmania Social Sciences HREC is Associate Professor Gino DalPont (+61 3 6226 2078) and the Executive Officer is Mrs Amanda McAully (+61 3 6226 2763).

For further information about the research please contact the Chief Investigators, Dr. Andras Kelly, School of Architecture, University of Tasmania or Dr. Margaret Robertson, Faculty of Education, University of Tasmania. Both, can be contacted by email: Andras.Kelly@utas.edu.au and Margaret.Robertson@utas.edu.au or by mail to:

Dr. Andras Kelly
School of Architecture
University of Tasmania
Locked bag 1-323
Launceston, Tasmania
AUSTRALIA 7250

Dr. Margaret Robertson
Faculty of Education
University of Tasmania
Locked Bag 1-307
Launceston, Tasmania
AUSTRALIA 7250

A summary of the investigation will be forwarded to you on request.

You may keep this Information Sheet and Statement of Informed Consent.

Dr. Andras Kelly

Dr. Margaret Robertson

Miss Maheran Yaman

INFORMATION SHEET FOR TEACHERS
A STUDY OF OUTDOOR EDUCATION FOR PRIMARY SCHOOLS IN MALAYSIA

My name is Miss Maheran Yaman and I am a Ph.D student in the School of Architecture at the University of Tasmania, Australia. My Principal Supervisor is Dr. Andras Kelly from the School of Architecture and my Co-Supervisor is Dr. Margaret Robertson from the Faculty of Education, University of Tasmania. Dr. Andras Kelly is the Chief Investigator of this project. The aim of my research is to investigate the potential use of outdoor spaces for teaching.

This study explores the possible benefits of outdoor learning in primary schools in Malaysia. The thesis background is based on the hypothesis that the increased use of outdoor classrooms in primary education in Malaysia could bring significant teaching and learning opportunities, as well as environmental, social and economic benefits. This thesis is in line with the intentions of the year 2001 Malaysian Minister of Education budget report proposes to budget for significantly more money to be spent on education.

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Names or other identifying information are not required so your anonymity is assured. Careful treatment will be given to ensure that there is no specific information that could be used to identify people and schools mentioned in the study. Coding will be used to refer to the subjects, particularly schools and participants. All data and information will be stored securely in a locked filing cabinet in the School of Architecture and kept confidential. Access to the information, including documents gathered, notes and transcripts, will be controlled and used to construct the final report. Data will be retained for five years and then shredded.

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Dr. Andras Kelly

Dr. Margaret Robertson

Miss Maheran Yaman

INFORMATION SHEET FOR EDUCATION OFFICER
A STUDY OF OUTDOOR EDUCATION FOR PRIMARY SCHOOLS IN MALAYSIA

My name is Miss Maheran Yaman and I am a Ph.D student in the School of Architecture at the University of Tasmania, Australia. My Principal Supervisor is Dr. Andras Kelly from the School of Architecture and my Co-Supervisor is Dr. Margaret Robertson from the Faculty of Education, University of Tasmania. Dr. Andras Kelly is the Chief Investigator of this project. The aim of my research is to investigate the potential use of outdoor spaces for teaching.

This study explores the possible benefits of outdoor learning in primary schools in Malaysia. The thesis background is based on the hypothesis that the use of outdoor classrooms in primary education in Malaysia could bring significant teaching and learning opportunities, as well as environmental, social and economic benefits. This thesis is in line with the intentions of the year 2001 Malaysian Minister of Education budget report proposes to budget for significantly more money to be spent on education.

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No risks or discomfort are anticipated. However, should you experience any discomfort, you may withdraw from the participation at any time, without prejudice.

If you agree to take part, you will be provided with a questionnaire to complete. It will take approximately thirty minutes. Upon completing the questionnaire, a short discussion will be conducted for fifteen minutes.

Names or other identifying information are not required so your anonymity is assured. Careful treatment will be given to ensure that there is no specific information that could be used to identify people and schools mentioned in the study. Coding will be used to refer to the subjects, particularly schools and participants. All data and information will be stored securely in a locked filing cabinet in the School of Architecture and kept confidential. Access to the information, including documents gathered, notes and transcripts, will be controlled and used to construct the final report. Data will be retained for five years and then shredded.

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Dr. Andras Kelly

Dr. Margaret Robertson

Miss Maheran Yaman

INFORMATION SHEET FOR BUILDING PROFESSIONALS
A STUDY OF OUTDOOR EDUCATION FOR PRIMARY SCHOOLS IN MALAYSIA

My name is Miss Maheran Yaman and I am a Ph.D student in the School of Architecture at the University of Tasmania, Australia. My Principal Supervisor is Dr. Andras Kelly from the School of Architecture and my Co-Supervisor is Dr. Margaret Robertson from the Faculty of Education, University of Tasmania. Dr. Andras Kelly is the Chief Investigator of this project. The aim of my research is to investigate the potential use of outdoor spaces for teaching.

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No risks or discomfort are anticipated. However, should you experience any discomfort, you may withdraw from the participation at any time, without prejudice.

If you agree to take part, you will be provided with a questionnaire to complete. It will take approximately thirty minutes. Upon completing the questionnaire, a short group discussion will be conducted for 15 minutes with participants.

Names or other identifying information are not required so your anonymity is assured. Careful treatment will be given to ensure that there is no specific information that could be used to identify people and schools mentioned in the study. Coding will be used to refer to the subjects, particularly schools and participants. All data and information will be stored securely in a locked filing cabinet in the School of Architecture and kept confidential. Access to the information, including documents gathered, notes and transcripts, will be controlled and used to construct the final report. Data will be retained for five years and then shredded.

This project has received ethics approval from the Southern Tasmania Human Research Ethics Committee and your school Headmaster/mistress.

If you have any concerns of an ethical nature or complaints about the manner in which the project is conducted you may contact the Chair or Executive Officer of the Southern Tasmania Social Sciences Human Research Ethics Committee.

The Chair of Southern Tasmania Social Sciences HREC is Associate Professor Gino DalPont (+61 3 6226 7569) and the Executive Officer is Mrs Amanda McAully (+61 3 6226 2763).

For further information about the research please contact the Chief Investigators, Dr. Andras Kelly, School of Architecture, University of Tasmania or Dr. Margaret Robertson, Faculty of Education, University of Tasmania. Both, can be contacted by email: Andras.Kelly@utas.edu.au and Margaret.Robertson@utas.edu.au or by mail to:

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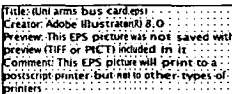
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Dr. Andras Kelly

Dr. Margaret Robertson

Miss Maheran Yaman



**SCHOOL OF
ARCHITECTURE**

Launceston

A Study of Outdoor Education for Primary Schools in Malaysia

1. I have read and understood the 'Information Sheet' for this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves the following procedures and it will take only thirty minutes of your time.
4. I understand that there are no risks or possible discomfort.
5. I understand that all research data will be securely stored on the University of Tasmania premises for a period of five years. The data will then be destroyed.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered for the study may be published provided that I cannot be identified as a subject.
8. I agree to participate in this investigation and understand that I may withdraw at any time without any effect.

N a m e o f subject

Signature of subject Date

9. I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he / she understands the implications of participation.

Name of investigator

Signature of investigator Date

Please indicate your permission for your teaching staff to participate by signing this letter on the following page and return it to Maheran Yaman.

I would be pleased to talk to you about the research.

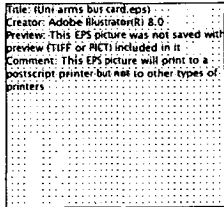
Name of Primary School

SIGNED AND ACCEPTED on behalf of the school by _____

SIGNATURE OF HEADMASTER/MISTRESS

Name of Headmistress /master / Teacher / Education Officer / Planner / Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer,

Signature



UNIVERSITY OF TASMANIA

SCHOOL OF
ARCHITECTURE
Locked Bag 1-323
Launceston
Tas 7250

Questionnaire: A Study of Outdoor Education for Primary Schools in Malaysia
This questionnaire is designed to find out your preferences for the teaching spaces

All reasonable efforts are made to keep the information gathered throughout the course of the research confidential, and details will not be released except in an aggregated form, from which individuals cannot be identified

Please complete all sections of this questionnaire

Section A – Background Information

1. Your age
2. School location (please circle) – city / suburban / rural
3. Gender (please circle) A. Male B. Female
4. Qualifications (please list and give place and date of completion)
.....
.....
5. How many years have you been working?
.....
6. Please list environmental education courses or programmes attended in the last five years if any or list the courses and professional programmes you have attended in the last five years
.....
.....
.....
.....
7. What year group do you teach?(please tick – this question is to be answer by teachers)

	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Year	1	2	3	4	5	6

Section B and C are to be answer by teachers only.

Section B – Spaces and uses at present (Please tick the relevant box)

The answers from section B will provide information about suitable time frames for outdoor education (For thermal comfort in classrooms information: All Malaysian government schools are mechanically ventilated)

1. Do you feel most physically comfortable teaching or in classes?
- A. Before break (8:00 – 10:30) ☐
 - B. After break (11:00 – 1:00) ☐
 - C. Before break (1:30 – 4:00) ☐
 - D. After break (4:30 – 6:30) ☐
2. Do you feel most physically uncomfortable teaching or in classes?
- E. Before break (8:00 – 10:30) ☐
 - F. After break (11:00 – 1:00) ☐
 - G. Before break (1:30 – 4:00) ☐
 - D. After break (4:30 – 6:30) ☐

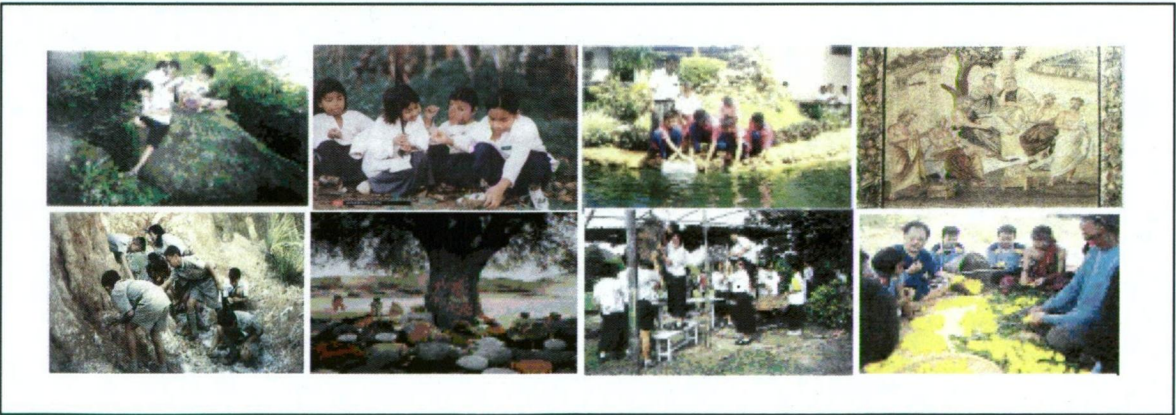
Section C – Spaces and preferences

The answers from section C will provide information on the choices of teaching and learning spaces

1. In which space do or would you prefer to teach?
- A. Indoors in a traditional classroom ☐
 - B. Outdoors but in a pleasant shady shelter ☐

Section D – Preference for teaching space

The answers from section D will provide information related to the type of teaching and learning spaces you prefer. The pictures below are examples of outdoor learning spaces. Please take a moment to consider these options as possible teaching spaces before answering



*Section D.***The subjects below could be taught outdoors**

	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
1. Languages (Bahasa and English)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. History	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Religious Education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Geography	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Arts, drama and music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Skills of life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section E – This section consists of three questions. (Questions 1 and 2 are to be answered by teachers only and question 3 is to be answered by the Education Administrator / Planner/ Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer).

To be answered by Teachers only.

Question 1 – Please give your view on the current quality of teaching and learning spaces in Malaysia.

To be answered by Teachers only.

Question 2 – Please give your view on how you see the development of future teaching and learning spaces in Malaysia given an ideal economic, political and cultural situation.

***Question 3A and 3B - are to be answered by Education Administrator / Planner/
Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer only.***

Question 3 (A) - Please give your views, based on your professional experience, on the existing primary school design within the present scenario of post-colonial education consisting of the environmental issues based on Islamic teaching and learning.

Question 3A and 3B - are to be answered by Education Administrator / Planner / Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer only.

Question 3 (B) – Please give your views on the future design of schools in the context of a developed regional education model with high Islamic principles (including a suitable environmental teaching and learning content) and generally high quality teaching and learning to suit Malaysia's future.

Thank you very much.

Age codes 1=20-30, 2=31-40, 3=41-50; Gender codes 1=Male, 2=Female; Qualification codes 0=Not mentioned, 1=O level, 2=A level, 3=Certificate, 4=Diploma, 5=Degree, 6=Post-graduate Diploma, 7=Master; Preferences to teach outdoor codes L=Languages, H=History, RE=Religious Education, G=Geography, S=Science, M=Mathematics, AD & M=Arts, Drama & Music and Sol=Skills of Life as 1-Strongly Agree, 2-Agree, 3-Not Sure, 4-Disagree and 5-Strongly Disagree*

Year group codes 1=Year 1, 2=Year 2, 3=Year 3, 4=Year 4, 5=Year 5, 6=Year 6; Comfort/discomfort teaching zone codes 1=before break (8:00-10:30), 2=after break (11:00-1:00), 3=Before break (1:30-4:00), 4=After break (4:30-6:30), 5=1&4, 6=1&3, 7=1&2, 8=2&3, 9=2&4, 10=3&4; Preferences teaching and learning spaces codes 1=Indoors in traditional classroom, 2=Outdoors but in pleasant shady shelter and 3=1&2 (Indoors in traditional classrooms and outdoors but in pleasant shady shelter)**

*Coding apply for all professionals practitioners samples

**CODING APPLY FOR TEACHERS SAMPLES ONLY

APPENDIX I

ANALYSIS OF QUESTIONNAIRE

Section E – This section consists of three questions. (Questions 1 and 2 are to be answered by teachers only and question 3 is to be answered by the Education Administrator / Planner/ Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer).

To be answered by Teachers only.

Question 1 – Please give your view on the current quality of teaching and learning spaces in Malaysia.

To be answered by Teachers only.

Question 2 – Please give your view on how you see the development of future teaching and learning spaces in Malaysia given an ideal economic, political and cultural situation.

Category Rural School	<u>Question 1 responses</u> Views on the current quality of teaching and learning spaces.	<u>Question 2 responses</u> Views on future teaching and learning spaces.
Teacher 1	Not suitable for every subject	Flexible and stimulating spaces
Teacher 2	Uncontrolled students (10)	State of the art
Teacher 3	No outdoor learning	Life long learning and facilitating
Teacher 4	Boring and exam orientated	Culture sensitive
Teacher 5	Mundane and exam orientated	Applicable everywhere
Teacher 6	Exam orientated	Applicable for all abilities
Teacher 7	Unbalanced	Wider view
Teacher 8	Chalk and talk routine	Flexible learning
Teacher 9	Exam orientated	Meaning full not just spaceless
Teacher 10	Exam orientated	Borderless knowledge
Teacher 11	Easy to control bored students	Freedom
Teacher 12	Control discipline and focus	Nature exploration

Category Urban school	<u>Question 1 responses</u> Views on the current quality of teaching and learning spaces.	<u>Question 2 responses</u> Views on future teaching and learning spaces.
Teacher 13	Not well equipped	Combine subjects in a space
Teacher 14	Less satisfied	More spaces (4)
Teacher 15	Student's focus is less than twenty minutes and need to control the class	Time assessment
Teacher 16	Indoor classrooms for control subjects such as Maths	More learning aid
Teacher 17	Bored and dull	Outdoor interaction lessons
Teacher 18	Uniformity	Educators opinion
Teacher 19	Backward	Skilful and psychology
Teacher 20	Sterile	Communicate with families
Teacher 21	Difficult to control	Teaching and learning facilities
Teacher 22	Not enough application in life	Bigger space with teaching and learning aids
Teacher 23	Exam orientated (6)	Behavioural education
Teacher 24	Nerd	Outdoor for weaker students' stimulation
Teacher 25	Not equipped	Access by students' performance

Category Sub-urban school	<u>Question 1 responses</u> Views on the current quality of teaching and learning spaces.	<u>Question 2 responses</u> Views on future teaching and learning spaces.
Teacher 26	Spoon-fed environment	Environment for enquiry or inventory
Teacher 27	Time versus too many students to control	More spaces
Teacher 28	Non-applicable outdoor knowledge and uncontrolled with increasing students number	Extra classes
Teacher 29	Easy to control students	Groups in classes for discussion
Teacher 30	Hot, noisy and unstimulating	Interesting and colourful
Teacher 31	Distant	More spaces
Teacher 32	Powerless	Challenge
Teacher 33	Too many students too control	Sensitive

Question 3A and 3B - are to be answered by Education Administrator / Planner / Architect / Landscape Architect / Quantity Surveyor / Mechanical Engineer only.

Question 3 (A) - Please give your views, based on your professional experience, on the existing primary school design within the present scenario of post-colonial education consisting of the environmental issues based on Islamic teaching and learning.

Question 3 (B) - Please give your views on the future design of schools in the context of a developed regional education model with high Islamic principles (including a suitable environmental teaching and learning content) and generally high quality teaching and learning to suit Malaysia's future.

Category Professional builder and Education Administrator	Question 3 (A) responses Views on existing primary school design.	Question 3 (B) responses Views on future primary school design
Education Administrator	Lasting building materials	Religious study equipment
Urban and Regional Planner	Senseless and rigid	Dynamic and safe
Architect	Prototype and dull	Humane and stimulating
Landscape Architect	No outdoor link	External space
Quantity Surveyor	Too formal and not enough spaces	Informal studying area and multi-racial lessons
Mechanical Engineer	Vandalism and high maintenance	Influential setting

Teacher 1

Question 1 responses: The current situations is a good approach when doing lessons in classrooms but not for every subjects.

Question 2 responses: Need more spaces so that students can absorb the knowledge in an open environmentally friendly situation. Teaching and learning indoors is becoming structured and causing students to be bored and they do not expect outdoor environment as a place to received education.

Generally both indoor and outdoor classrooms should be practiced in future.

Teacher 2

Question 1 responses: The teaching and learning in Malaysia is focused indoors because:

- The big number involved in each classrooms (35-45).
- Class control - Teachers should be able to control students.
- Students' readiness.

Question 2 responses: A bright future due to the present teachers' exposures to IT such are:

- Teaching materials are prepared carefully and are 'state of the art.'
- The use of LCD, projector and CD is explored with students.

Teacher 3

Question 1 responses: Not all subjects are taught indoor or outdoor only. It is based on activities' suitability. Sometimes it is needed to be performed indoor and outdoor. To continue and cultivate student interest, outdoor teaching and learning should be improved. Subjects such as Science especially should be performed outdoor for life studies.

Question 2 responses: To improve the teaching quality the current system is volatile. Somehow, the style and teaching environment should follow the National Education Philosophy which is to give life long learning covering physical, soul, emotional and intellectual for examples: The use of English for subject such as Science and Mathematics which are conducted in January 2003. The involved stages are Primary one children only. This gives opportunities for students to be exposed and practice English for competition with other nations as an international language. The change of the new subjects is in need, though teachers should play a bigger role to teach in constructivity (children do first and teachers help with explanation).

Teacher 4

Question 1 responses: These are not stimulating, are of lesser quality mainly for exam orientated and no moral value, and are not applicable in daily life.

Question 2 responses: The education system should be improved and change to bring about improvements in intellectual achievement but not in moral values.

Teacher 5

Question 1 responses: Education is mainly for examinations. Quality for teaching improvement is continuous but is not applied fully.

Question 2 responses: Intellectual education is improving and renewing but lesser moral realisation leads to bad lifestyle.

Teacher 6

Question 1 responses: The advantages is there are good opportunities if educating way is properly planned. The disadvantage is too much exam disorientation.

Question 2 responses: Changes should be made based on the syllabus so that it is suitable with students' level and abilities.

Teacher 7

Question 1 responses: The present educating technique is less effective towards primary schools' students. Attention is needed for weaker students to obtain guidance especially in Mathematics. In the present situation they are neglected. If the teachers do not realise these situation and do something to improve their students they will be left behind in every aspect. Exercise and communication between teachers and students is lacking.

Question 2 responses: For the future, it is hoped that the education system will be more comfortable and better for primary school students. Thus, lessons should be the focused on using outdoor spaces to change students' views.

Teacher 8

Question 1 responses: The learning concept based on 'chalk and talk' bores the students. Sometimes subjects or lesson objectives are unachievable especially for weak students. The indoor classroom teaching routines causes loss of interest among students to learn.

Question 2 responses: The flexible learning concept based on students' capabilities learning not just from indoors. Teachers as facilitator and students discuss among themselves in groups. The product of discussion will be commented upon by teachers.

Teacher 9

Question 1 responses: The present education system is based on examinations and paper qualification for future jobs. Social and moral values are excluded. Achievement is measured on education but not moral values even though education is a way to energise the nation.

Question 2 responses: Education in Malaysia will be more successful with modern facilities, which is suitable with the state of the art. The traditional system is still applicable, because without teachers, teaching is meaningless.

Teacher 10

Question 1 responses: Nowadays, education is different from previous times. The technique and the previous system gave more impact to students' achievements. In those days all learning aspects came together. Now, teaching is concentrated toward one aspect only which is specialisation. Perhaps, other aspects of education should be applied too.

Question 2 responses: It is suitable with the state of the art – IT because:

- It attract students interest.
- It orientated with globalisation.
- It borderless knowledge.
- Education has good values instilling

Teacher 11

Question 1 responses: Among the advantages of present indoor classroom are:

- It is easier for teachers to control students.
- It is easier for students to pay attention.

Among the disadvantages of indoor classroom are:

- Students get easily bored.
- Students fall sleepy more quickly.

Among the advantages of outdoor classroom are:

- Students are not easily bored.
- Teachers can conduct a lot of activities.

Among the disadvantages of outdoor classrooms are:

- It's harder for teacher to control a lot of students.
- There are more chances for students to be distracted with a lot of playing opportunities

Question 2 responses: The teaching, learning and educating process in Malaysia is balanced with indoor and outdoor classrooms elements. From Monday – Friday there will be a lot of indoor classrooms and twice a month there will be outdoor activities with freedom given to the teacher anything suitable for the students.

Teacher 12

Question 1 responses: Among the advantages of present indoor spaces are:

- There is an ideal number for students.
- The discipline can be controlled.
- The focus can be given to students.
- There are suitable for subjects related reading and theory.

Among the advantages of present outdoors paces are:

- Small number of students.
- Teachers need more preparation.
- Discipline among students are difficult.
- There are suitable for subjects related to nature and practical.

Question 2 responses: Teaching and learning could be done outdoors because it is more interesting and will give more opportunities for students to explore nature.

Teacher 13

Question 1 responses: The education quality is less due to too many subjects. Teachers are burdened with a lot of other non-optional work. Schools' infrastructure is not good.

Question 2 responses: The education quality could be improved by:

- Combining side subjects with the basic subjects such as skills of life in Science subjects.
- Lessening teachers' burden so that concentration on subject teaching is more.
- Maximum IT facilities.

Teacher 14

Question 1 responses: There is less satisfaction and not many facilities.

Question 2 responses: There is need to add spaces in the classroom and technology.

Teacher 15

Question 1 responses: Indoor classrooms are suitable for certain subjects only. Concentration time in primary school students is twenty minutes only for each learning session, thus teachers usually choose the indoor environment. Conducive environments could be created by making the classrooms look cheerful so that the children will feel comfortable.

It is true that students will get easily bored and they should be given a chance to choose a learning environment based on their interest and abilities according to the subjects.

Question 2 responses: Any conducive environment will do regardless of being indoor or outdoor. Time given for each subject should be sufficient to enable students to focus.

Teacher 16

Question 1 responses: It is suitable to use indoor classrooms for certain subject such as Mathematics. The outdoor classroom is for skill subjects such as physical education.

Question 2 responses: To give opportunities for students to do more activities outdoors. To add more learning aid to students so that they are more interested to learn.

Teacher 17

Question 1 responses: It is suitable to use indoor classrooms for certain subjects such as Mathematics and History. Outdoor classroom is suitable:

- to avoid boredom.
- to create a conducive teaching and learning environment.
- to concentrate or better understanding i.e – religious education subject (to show creator's creation), english subjects (using trees and plants as examples), mathematics in Year 1, physical and health education.

To be in classrooms all the time make students and teachers bored and cause teaching and learning to dull.

Question 2 responses: To give student chances to do outdoor activities including suitable teaching and learning through the curriculum. Also, not too many students in the classroom so that the students and teacher can focus better. Classroom should be equipped with proper aid to ease teaching and learning. Teaching and learning can be more effective and success if students are allowed to go out on certain teaching topics

Teacher 18

Question 1 responses: Overall teaching and learning in Malaysia is good but there are certain matters should be solved for effective teaching such as the uniformity and equal distribution for schools facilities all over Malaysia because, there are some schools who received better facilities than others.

Among the advantages of teaching in indoor classroom are:

- Students can focus clearly.
- Not many distractions.
- A comfortable teaching environment.

Among the disadvantages of teaching in indoor classroom are:

- Students can get bored easily due to the same environment every day.
- Teaching after 11.00 am is not comfortable at all.

Among the advantages of teaching in outdoor classroom are:

- Teaching can be more effective due to the differences of environment.
- Variation of teaching strategy and technique can be applied.

Among the disadvantages of teaching in outdoor classrooms are:

- Students focus is not fully due to environmental disturbances.
- Time wasted to move from one spot to another and influential factors such as weather changes.

Question 2 responses: A better and effective system, a complete infrastructure and facilities for all schools rural, sub-urban or urban. Before any enactment starts there should be a studies of educators opinions. The Malaysian education system is not influenced by political factors [sic]. All schools should be in 1 session only because teaching in the evening is not suitable and students are not interested.

Teacher 19

Question 1 responses: The quality is acceptable for the second world nation standard. It varies through schools and location, in an urban area. The quality should be upgraded especially, IT facilities.

Question 2 responses: In the case of primary schools in Malaysia, the introduction of teaching Maths and Science is still at infant level. However, for future teaching, teachers should be more flexible and skilful in conveying knowledge to students. Teachers must be computer literate and adopt student-centred strategies in their approach. Teaching aids should be used at large and especially for primary students. Psychologically teacher must be prepared. In case of learning spaces in Malaysia, whether class should be conducted outdoors – studying outdoors has been adopted long ago. However, it diminished as more modern buildings have been built. We can start the tradition again, thus compare and contrast its effectiveness. It is up to teachers' strategies to make teaching interesting.

Teacher 20

Question 1 responses: It is good due to teachers being sent for courses to get more knowledge. Teaching and learning has always been accessed and improved by Ministry of Education, Malaysia.

Question 2 responses: To increase teachers knowledge, the teachers need to be send to attend courses related to the subjects they are teaching. The Ministry of Education should always make a study on teachers', students' and parents' problems.

Teacher 21

Question 1 responses: Teaching and learning spaces in Malaysia are not very good. There are unnecessary facilities in classroom and it is difficult to control the class.

Question 2 responses: There are a lot of facilities that should be available for students and teachers to use.

Teacher 22

Question 1 responses: Every Tuesday outdoor spaces are used for students' health and safety.

Question 2 responses: There is need to prepare a bigger classroom with a lot of facilities for teaching and learning.

Teacher 23

Question 1 responses: Many positive changes occurred in teaching and learning in Malaysia especially teaching Science and Mathematics in English in order to upgrade the quality of the language among the students. Students should be exposed to the information technology starting from their primary level. Teaching and learning should not only stress an educational aspect, but also consider on shaping the quality of students in the aspect of their behaviour.

Question 2 responses: -Nil-

Teacher 24

Question 1 responses: Teaching outdoors is most comfortable at 8.00 am in the morning. Outdoor teaching is suitable for weaker students especially the illiterate students. The outdoor application should be practised due to Malaysian students' opportunities with multiple languages.

Question 2 responses: The time table arrangement should be changed. Students are not interested to come to school especially the weaker students. With outdoor opportunities it will stimuli them to come to schools. IT classes and other computer technology should be practised.

Teacher 25

Question 1 responses: The current quality has improved a lot from:

- The quality of IT facility.
- The teaching and learning method.

Question 2 responses:

With good students performance now, the future is bright not otherwise.

Teacher 26

Question 1 responses: The teaching and learning standard in Malaysia can be categorised as average due to the lack of media such as computer, television, radio and teaching aids. Students are still being 'spoon-fed' with information instead of enquiry or inventory due to lack of amenities. Schools usually own one television, one video and limited space for outdoor teaching and learning.

Teaching and learning is still students orientated though, time is limited among teachers. But, still teachers try to maximise teaching materials. Teachers have been burdened with other jobs which limit them to give their full attention to teaching and learning such as:

- To make schools more aesthetically pleasant.
- To attend many meetings.
- Other unnecessary works.

Question 2 responses: It looks good as some new sub-urban school, which is well equipped with proper teaching and learning aid. Every classes are equipped with fifteen to twenty computers compared to other schools. Their surrounding environment is reasonable too for outdoor purposes, which should be available in other schools.

Teacher 27

Question 1 responses: Teachers are burdened with other activities such as clerical and administration, paperwork. More time should be given to concentrate on teaching, to prepare proper lessons before classes.

Question 2 responses: More students are going to school every year. More teachers and spaces are needed.

Teacher 28

Question 1 responses: In a situation where there are too many students in the classroom the flow of teaching and learning is disturbed. There should be a special syllabus for weaker students so that they receive proper attention. Students try to avoid thinking in the process of teaching and learning. Knowledge in school is not applied at home. Students easily give up in searching for answers, in a problem form.

Question 2 responses: Those students who are weaker in English will be left behind if subjects such as Science and Mathematics are conducted in English. So, extra English classes should be conducted for students who are weaker so that when classes are conducted in English they will be able to understand the teaching and learning.

Teacher 29

Question 1 responses: Among the advantages are:

- A proper environment and place.
- Easy to control students.

Among the disadvantages are:

- Not a comfortable place.
- It is hard to control students.

Question 2 responses: In classes students should be in groups for discussion purposes in teaching and learning.

Teacher 30

Question 1 responses: Among the advantages are:

- Equipped teaching and learning aid in classroom.
- The peace environment in the morning.
- Aesthetic furnitures for classroom interior.

Among the disadvantages are:

- Hot weather at noon.
- Noisy environment.
- The mood to study is less after break in the morning.
- The chalk is not suitable due to dust and hazard.

Question 2 responses: Try to create the classrooms to be more interesting and colourful.

Teacher 31

Question 1 responses: The teaching and learning area is limited, furthermore teaching aids are far away and it is a waste of time to get them.

Question 2 responses: There will be more spaces and well-equipped with teaching aids for teaching and learning

Teacher 32

Question 1 responses: Young teachers are less interested in effort of teaching and learning. Parents perception on their children and teachers make teachers powerless.

Question 2 responses: The teaching profession is becoming more challenging and there are a lot of changes in IT. Teachers should exposed themselves with IT and accommodate teaching and learning with IT. The use of English is expanding related to its suitability and importance.

Teacher 33

Question 1 responses: There are too many students, thus make the management of teaching and learning harder. There are not enough teachers or assistant teachers for teaching and learning, rehabilitation and classes disciplines and not enough teaching aid to ease teaching and learning requirement.

Question 2 responses: There will be enough lessons exercise so that teachers will be sensitive to the teaching and learning problems. To equip teachers with IT knowledge, there will be need for professional training. To involve parents from professionals background to help teachers with subjects and sports.

Education officer feedback

In answering question 1, based on ten years experience of the education system, the education officer, views of the existing primary school design, is that it is good for the surrounding climate in Malaysia. For example the classrooms is

designed using the 'opening' concept for cross ventilation and natural sunlight during the teaching and learning period. Additionally, nowadays new schools are built in the housing areas which are lesser congested with traffic and high-rise building such as pre-colonial schools in the cities. Furthermore the air quality in housing area is better than the polluted air quality in an urban area. Building material is mainly concrete for security purposes on matters such as fire retardant compared to timber, as used on pre-colonial schools.

In question 2, the education officer views the future design of primary schools in the context of a developed regional education model with high Islamic principles (including teaching and learning content) and generally high quality teaching and learning to suit Malaysia's future. The future of the primary school design should not be change (100%) from the present school. The only changes needed is on the special classes for lower primaries school level such as for children seven to nine years olds. Computer and science laboratories will be built separately for easier management purposes. The most important thing is to plan a design for classrooms, which allows proper teaching can be conducted. Currently, most primary schools have their own prayer room, (*surau*) usually a contribution from the community. It is hoped in the future during planning for new primary school building, there will be an allocation for *surau* separately, so that subjects such as religious education can be conducted smoothly and will achieve the teaching and learning objective.

Urban and town planner feedback

The urban and town planner view of the existing primary school design, is that it seems:

- Compact and crowded.
- There is not much space for opportunities to do extensions or to rebuild.
- There are symmetrical in design and difficult to differentiate between one school and another or there is no individual identity for each school.
- Some locations are dangerous with security, transport, traffic circulation, community influences.

On the views of the future design of primary schools in the context of a developed regional education model with high Islamic principles (including teaching and learning content) and generally high quality teaching and learning to suit Malaysia's future the urban and town planner stated that there is need for conducive learning spaces and overall environmental design (landscaping and building materials, structures and spatial arrangement).

To be at the state of the art, where the design and teaching is adaptable to the ever-changing technology such as computerised on e-schools with:

- Social Impact Assessment considerations.
- Environmental Impact Assessment input.
- Crime Prevention and The Environmental Design (CPTED) precaution.
- Provision for life-long learning.

Architect feedback

In answering question 1, which is the view of the existing primary school design, the architect said that generally primary schools constructed in Malaysia by the government follow the standard design. This is mainly to facilitate the fast completion of schools to meet the fast growing population. It is believed that the spaces that we experience during our formative age will shape our characters. Primary school children in Malaysia spend more time per day in school hours than in their homes. Since most of the times spent are in schools, spaces experienced by the children should be varied and leave a lasting and memorable impressions for them. At the moment the 'regimented' design of standard schools give mundane and dull spaces which is not stimulating positively as a sense of place for children.

For question 2, on the views of the future design of primary schools, the architect wrote that the common saying by the Prime Minister and Deputy Minister is that Malaysia has world class facilities in buildings but a third. class world mentality. This is because there is so much money spent on buildings and technology investment but little investment in people. In order to design schools, questions should be ask of what kind of products needed to be produced from the schools. Do we want children who only excel in education but have no sense of belonging to their community and fellow beings? Children should be thought good values early in their life so that they become responsible people when they grow-up - responsible to their fellow being and most importantly to their environment. This is basically the concept of being a 'khalifah' (viceregent) as being required by Islam. With this concept it is hoped those in the field of education can formulate primary schools that will develop the human aspects of the children while developing the technical aspects of learning.

Landscape architect feedback

Answering question 1, 'the view of the existing primary school design', the landscape architect stated, it would be good and useful if primary school design included more external spaces because at the moment, the existing design:

- Does not allow any outdoor learning.
- The syllabus does not include outdoor activity.
- Building design should be more friendly, airy and comfortable.

Question 2 answers, 'on the views of the future design of primary schools the architect stated, besides having good external spaces in the primary school, the learning content, also should include field trips to exciting places to stimulate the students' minds.

Quantity surveyor feedback

The quantity surveyor's answer for question 1 was that existing primary school design were:

- Lacking in classroom space.
- The ambience of the school environment needs to be upgraded.
- Generally school design should be more cheery, less formal and more suitable to 'kids' in order to inculcate activity among them.

For question 2 the quantity surveyor views of the future design of primary schools as generally high quality teaching and learning. Being a country with a multi-racial population, and Islam being the official religion, a harmonic balance should be the basis for design. Islamic-based design characteristics can be included. Informal environmentally related study, as practiced by the prophet Muhammad, can be introduced so that the learning process can be as informal but still not lose the teaching content.

Mechanical engineer feedback

Responses from the mechanical engineer included disadvantages and advantages. They are:

Advantages:

- There are a lot of proper facilities such as a play field, playground, library and canteen and
- The school is fenced for security.

Disadvantages:

- The school site is next to a busy and noisy road,
- The standard design is dull and not creative and
- Crowded lay by (parking) or waiting area.

In responses to question 2:

- Before building schools the location should be identify as a proper setting because it can influence childrens' achievement and
- Maintenance is high for vandalism in primary schools due to negative issues.

APPENDIX J
SUMMARY KEYWORDS ANALYSIS FROM PARTICIPANTS IN
APPENDIX I

	Hopes	Visions
	Optimistic	Views
Rural school	<p>Example 1: More spaces so that students can absorb the knowledge in a friendly and open environment.</p> <p>Example 2: The teaching and learning method is focused indoor because:</p> <p>Due to number of students (35-45). teachers need to emphasise control of the class.</p> <p>Example 3: To continue to cultivate students' interest, outdoor teaching and learning should be practised to improve and continues the present education quality, especially for subjects such as Science.</p> <p>Example 4: A good way of educating is an opportunity to plan according to the teacher's ability and skill.</p> <p>Example 5: The current situation allows good control of students by the teacher and makes it easier for students to focus.</p> <p>Example 6: The current teaching and learning space allows a big number of students. Their discipline and focus can be controlled. It is suitable for subjects related to reading and theory.</p>	<p>Both indoor and outdoor classrooms should be practised.</p> <p>State of the art indoor technology exposure to teaching and learning aids.</p> <p>Education to facilitate and construct life long learning covering physical, soul, emotional and intellectual aspects.</p> <p>Change of syllabus to suit students' ability.</p> <p>Students are not easily bored and teachers can conduct a lot of activities.</p> <p>Teaching and learning should be able to be performed outdoors because it is more interesting and will give more opportunities for students to explore nature.</p>

	Hopes	Visions
	Pessimistic	View
Rural school	<p>Example 1: The exam orientated method is not applicable to daily life.</p> <p>Example 2: Education is a preparation for examinations. Thus, teaching quality improvement continues, but with limitations.</p> <p>Example 3: The present techniques are less effective. Attention is needed for weaker students especially in Mathematics. At present they are neglected. If the teachers do not realise this situation and something is not done in the future these students will be left behind. In certain schools this happens because there is a lack of communication between the students and teacher. Such students need special lessons and exercises, which can be achieved by communicating with the teacher. Some teachers do their responsibility 'half-hearted' only in the name of 'teacher' and not for the purpose of the noble education profession.</p> <p>Example 4: The concept of 'chalk and talk' bores students and the indoor classrooms teaching routine causes the loss of interesting learning. This leads to the education objective not being achieved, especially by weaker students.</p> <p>Example 5: The present system is based on paper qualifications and is exam orientated for future job markets. Social and moral values are excluded. Merit is based on good grades, not morals.</p> <p>Example 6: Education nowadays, is different from previous times. More emphasis is given to academic achievement. Focus is more on one aspect of specialisation. Before, all aspects of life long learning were equally valued.</p> <p>Example 7: At present students get bored and sleepy easily. There is not much chance for students to play and learn and stay focused simultaneously.</p> <p>Example 8: The present space is effective for small numbers of students. If more, their discipline and focus are uncontrolled by the teacher. Teachers need to prepare the teaching material. It is not suitable for subjects related to nature.</p>	<p>More improvement on behavioural adaptation rather than just intellectual achievement.</p> <p>Achievement of results is upgraded but with emphasis on morals to balance the way of life.</p> <p>The education system needs to be more comfortable and better for students. Thus, lessons should be focussed on the outdoors to change student views.</p> <p>A flexible learning concept based on students' capabilities. Learning does not just occur in indoor classrooms. There should be more of teachers as facilitators and student discussions. The discussion outcomes will receive comments from the teacher.</p> <p>With suitable state of the art facilities, the traditional system education would be more successful.</p> <p>-Fostered by state of the art IT facilities. -Attract students' interest. -Globalisation orientated. -Borderless knowledge. -Instilling moral values.</p> <p>Chances for students to stay focussed, with a lot of play and learn opportunities.</p> <p>Teaching and learning could be more spontaneous and natural in an informal interesting environment, with practical educational aids.</p>

	Hopes	Visions
	Optimistic	Views
Urban School	<p>Example 1: Indoor classrooms are suitable for certain subjects only because concentration time in primary school students aged from seven to twelve years is twenty minutes only for each learning session; thus teachers usually choose indoor environments in order to control the situation. Conducive environments can be created by making the classroom look cheerful so that the children will feel comfortable.</p> <p>Example 2: Suitable for subjects such as Mathematics only and not meant for physical-related subject.</p> <p>Example 3: The indoor classroom at present is suitable for certain subjects such as Mathematics and History. While with outdoor classrooms:</p> <ul style="list-style-type: none"> i- boredom is avoidable. ii- it is possible to create conducive teaching and learning environments. iii -students can concentrate and understand the subject better with the help of teaching and learning aids – especially in subjects such as religious education, (showing the Creator's creation), English subjects (using trees and plants as examples), mathematics in early years, physical and health education. <p>To be in classrooms all the time can make students and teachers bored and cause teaching and learning to be dull.</p> <p>Example 4: Teachers are sent on courses to obtain more knowledge. Teaching and learning improvements have always been a focus of the Ministry of Education, Malaysia.</p> <p>Example 5: A lot of facilities can be manipulated for teaching and learning use.</p> <p>Example 6: Many positive changes occurred in teaching and learning in Malaysia, especially teaching Science and Mathematics in English, in order to upgrade the quality of the language among the students. Students should be exposed to Information Technology starting from the primary level. Teaching and learning should not only stress educational aspects, but also consider shaping the quality of students in every aspect of their behaviour.</p> <p>Example 7: Teaching outdoors is most comfortable at 8:00 in the morning. Thus outdoor teaching is suitable for weaker students especially the illiterate students. The outdoor application should be practised due to Malaysian students' opportunities to learn multi languages.</p>	<p>Students should be given a chance to choose a learning environment based on their interest and abilities according to the subjects so that their interest is sustained and they do not get bored so easily. Any environment will do- regardless of being indoor or outdoor. Time given for each subject should be assessed again to find out the best way to teach so that children can focus on the main priorities.</p> <p>To give opportunities for students to do more activities outdoors and to add more learning aids so that they are more interested to learn.</p> <p>To give students chances to do outdoor activities including suitable teaching and learning through the curriculum.</p> <p>Not too many students in the classroom so that students and teachers can focus better.</p> <p>Classroom should be equipped with proper aids to facilitate teaching and learning.</p> <p>Teaching and learning can be more effective and successful if students are allowed to go out for certain teaching topics.</p> <p>To increase teachers' knowledge, teachers should be sent to attend courses related to the subjects they are teaching. The Ministry of Education should always support teacher, students and parents.</p> <p>To prepare a bigger classroom with a lot of facilities for teaching and learning.</p> <p>Time-table arrangements should be amended. Students are not interested to come to school especially the weaker students. With outdoor opportunities it will stimulate them to come to school.</p>

	Hopes	Visions
	Pessimistic	View
Urban School	<p>Example 1: The quality is less due to too many subjects. At the same time teachers are burdened with a lot of administration and poor equipment.</p> <p>Example 2: There is less satisfaction due too few teaching and learning facilities.</p> <p>Example 3: Overall the teaching quality is good but the uniformity in distributing teaching aids is not equal. Indoor classrooms are good, because students can focus clearly and there are not many distractions, except students can get bored easily due to the same dull environment daily. This is due to the comfortable teaching environment, except after 11:00 am when it is no longer comfortable.</p> <p>Example 4: Though Malaysia is considered as a developed country, the quality of education is acceptable for second world nation standard. It varies by schools and location. In an urban area the quality should be upgraded especially IT facilities.</p> <p>Example 5: The current quality of teaching and learning spaces in Malaysia is not very good, due to some unnecessary facilities in the classroom thus causing difficulties to control classes.</p>	<p>The quality can be improved by combining subjects. This will lessen teachers' burden so that concentration and preparation on teaching subject is increased. Maximum IT facilities are needed.</p> <p>Spaces for classrooms and technology are needed.</p> <p>Teaching can be more effective with the internet offered by the outdoor environment. The worry is students may not focus fully due to the environmental disturbance. Thus, teachers have to prepare more to mitigate against this problem. Time is wasted moving from one spot to another and influential factors such as weather are concerns. In summary there is need for:</p> <ul style="list-style-type: none"> -A better and effective system. -Better infrastructures and facilities for all schools, rural, sub-urban or urban. -Evaluation studies of educators' views. -The Malaysian education system to be less influenced by political factors. -All schools should be in one session only because teaching in the afternoon is not suitable and students are not interested. <p>In the case of primary schools in Malaysia, the introduction of teaching Maths and Science is still at the infant level. However, for future teaching, teachers should be more flexible and skilful in conveying knowledge to students. Teachers must be computer literate and adopt student centred strategies in their approach. Teaching aids should be used extensively and especially for primary students – psychologically teachers must be prepared. In the case of learning spaces in Malaysia, studying outdoors was adopted long ago. However, it diminished as more modern buildings were built. Is it up to teachers' strategy to make learning interesting.</p> <p>A lot of facilities should be made available for students and teachers to use.</p>

	Hopes	Visions
	Pessimistic	View
Sub-urban school	<p>Example 1: The current quality of indoors teaching and learning spaces in Malaysia can be categorised as average, due to the lack of resources such as: computers, televisions, radios and teaching aids. Students are still being 'spoon-fed'; supplied with information instead of enquiry or invention, due to lack of amenities. Schools usually own 1 television, 1 video and have limited space for outdoor teaching and learning. Teaching and learning is still teacher orientated. Time is limited among teachers but still teachers try to maximise teaching materials. Teachers are burdened with other jobs which limit their time for full attention to teaching such as:</p> <ul style="list-style-type: none"> i. to make schools look aesthetically pleasing. ii. attending many meetings. iii. other unnecessary work. <p>Example 2: Teachers are burdened with other activities such as clerical and administration work and paperwork. More time should be given to concentrate on teaching, to prepare proper lessons before classes.</p> <p>Example 3: In a situation where there are too many students in the class, the flow of teaching and learning is disturbed. There should be a special syllabus for weaker students so that proper attention can be focussed on them. Students try to avoid thinking in the learning process. Knowledge gained in school is not applied at home. Students easily give up in searching for an answer to problems.</p> <p>Example 4: The current teaching and learning space is not a comfortable place for teachers and it is hard to control students.</p> <p>Example 5: The environment is hot at noon and noisy. The mood to study is less after a break in the morning. Chalk is not suitable due to dust hazards.</p> <p>Example 6: The teaching and learning area is limited. Furthermore, teaching aids are few and it is a waste of time to get them.</p> <p>Example 7: Young teachers are less interested in teaching and learning. Parents' perceptions of their children and teachers -is that teachers are powerless.</p> <p>Example 8: Too many students in a class (40 and more) make the management of teaching and learning harder. There are not enough teachers or assistant teachers, or rehabilitation and class discipline. There are not enough teaching aids to facilitate teaching and learning. Classes are:</p> <ul style="list-style-type: none"> . Compact and crowded. . There is not much space for opportunities to do extension work. . Symmetrical in design and difficult to differentiate between one school and another. . There is no individual identity for each school. . Dangerous – security, transport, traffic circulation, community influences. 	<p>It looks good at some new suburban schools, compared to other schools. Suburban schools are well equipped with proper teaching and learning aids. Every class is equipped with 15-20 computers. Their surrounding environment is reasonable too for outdoor purposes.</p> <p>More students are going to school every year, more teachers and spaces are needed.</p> <p>The students, who are weaker in English, will be left behind if subject such as Science and Mathematics are conducted in English. Extra English classes should be conducted for students who are weaker, so that when classes are conducted in English they will be able to understand. In classes students should be in smaller groups for discussion purposes in teaching and learning.</p> <p>The classroom or any teaching and learning area should be more interesting and colourful.</p> <p>There will be more spaces, well- equipped with teaching aids.</p> <p>The teaching profession is becoming more challenging and there are a lot of changes in IT. Teachers should inform themselves about IT and accommodate teaching and learning with IT. The use of English is expanding related to its suitability and importance. Lessons and exercises should be varied, so that teachers can be sensitive to different aspects of teaching and learning. There is a need to equip teachers with IT knowledge and involve parents from professional background to help teachers with subjects and sports.</p>

Professionals	Realisation	Hopes
Education officer	The existing primary school design, is related to the surrounding climate in Malaysia. For example the classroom design uses the 'opening' concept for cross ventilation and natural sunlight during teaching and learning periods. Additionally, nowadays new schools are built in housing areas which are lesser congested with traffic compared with high-rise buildings near pre-colonial schools in the cities. Furthermore, the air quality in the housing area is better than the polluted air quality in urban areas. Building materials are mainly concrete for security purposes and matters such as fire retardant compared to timber as used in pre-colonial schools.	The primary school design should not be changed 100% from the present school. The only changes needed are for the special classes for lower primary school level such as for children seven to nine years old. A computer and science laboratory will be built separated for easier management purposes. Currently, most primary schools have their own prayer room (surau) which is usually a contribution from the community. It is hoped in the future during planning for new primary school buildings, there will be an allocation for a separate room for 'surau' so that subjects such as religious education can be conducted smoothly and achieve the teaching and learning objective.
Urban and Regional Planner	Schools are: <ul style="list-style-type: none"> . Compact and crowded. . There is not much space for opportunities to do extensions or to rebuild. . Schools are symmetrical in design and difficult to differentiate between one school and another. . There is no individual identity for each school. . Schools are dangerous because of security, transport, traffic circulation, community influences. 	There will be conducive learning spaces and overall environmental design (landscaping and building materials, structures and spatial arrangement) Schools will be state of the art, where the design and teaching is adaptable to the ever-changing technology such as computerised e-school. There will be: <ul style="list-style-type: none"> . Social Impact Assessment. . Environmental Impact Assessment input. . Crime Prevention and The Environmental Precaution (CPTED). . Life-long Learning
Architect	Generally primary schools constructed in Malaysia by the government follow a standard design. This is mainly to facilitate the fast completion of schools to meet the fast growing population. It is believed that the spaces we experience during our formative age will shape our character. Primary school children in Malaysia spend more time per day in school hours than in their homes. Since most of the time spent is in schools, spaces experienced by the children should be varied and leave a lasting and memorable impression for them. At the moment the 'regimented' design of standard schools gives mundane and dull spaces which are not stimulating as a sense of place for children.	A common saying by the Prime Minister and Deputy Minister is that Malaysia has world class facilities in buildings but a third class world mentality. This is because there is so much money spent on buildings and technology but little investment in people. In order to design schools, questions should be asked about what kind of products need to be produced from the schools. Do we want children who only excel in education but have no sense of belonging to their community and fellow beings? Children should be taught good values early in their life so that they become responsible people when they grow-up - responsible to their fellow beings and most importantly to their environment. This is basically the concept of being a 'khalifah' (viceregent) as required by Islam. With this concept it is hoped those in the field of education can formulate primary schools that will develop the human aspects of the children while developing the technical aspects of learning.
Landscape Architect	It would be good and useful if primary school design included more external spaces because at the moment, the existing design: <ul style="list-style-type: none"> . Does not allow any outdoor learning. . The syllabus does not include outdoor activity. . The building design should be more friendly, airy and comfortable. Schools are: <ul style="list-style-type: none"> . Lacking in classroom space. . The ambience of the school environment can be 	Besides having good external spaces in the primary school, the learning content also should include field trips to exciting places to stimulate the students' minds. Being a country with a multi-racial population, and Islam being the official religion, a harmonious

APPENDIX K

CONFERENCE REFEREED PAPER PRESENTED AT UNIVERSITY OF QUEENSLAND HELD ON THE 1-5 JULY 2002 AT HAWKEN BUILDING, SCHOOL OF ARTS AND MEDIA STUDIES.

**OUTDOOR LEARNING IN THE SCHOOL GROUNDS:
A STUDY OF PROPOSED ADDITIONAL OUTDOOR CLASSROOMS FOR
PRIMARY SCHOOLS IN KUALA LUMPUR MALAYSIA**

By:

Prof. Dr. Roger Fay, Dr. Andras Kelly, Kerry Van den Berg and Maheran Yaman

School of Architecture

University of Tasmania

Locked Bag 1-323

Launceston, Tasmania,

7250, Australia

e-mail: myaman@utas.edu.au

Abstract

This study is about opportunities for the use of outdoor classrooms in tropical climates, such as Kuala Lumpur in Malaysia. It investigates the possible advantages of teaching and learning school subjects at primary level, in outdoor classrooms in Malaysia, using the outdoor environment to improve student comfort levels and to provide enhanced learning opportunities. Preliminary investigations of hypothetical post occupancy evaluations and thermal comfort studies have shown positive results for outdoor classrooms in 'heat island' urban areas such as Kuala Lumpur. The paper also considers the economic benefits of reduced building costs. This paper reports on the ongoing research towards possible improvements to the 'indoor exam orientated' school system in tropical countries like Malaysia. It is a part of ongoing Ph.D research at the School of Architecture at the University of Tasmania.

1.0 Introduction

This paper is a part of the general research to establish the benefits of open-air classroom learning in tropical climates. It focuses particularly on Malaysia where education is structured and formal and takes place in indoor classrooms, often with inadequate provisions for user comfort. The paper describes some of the promising potential benefits of outdoor classrooms and describes solutions to the problems of providing shaded, open-air classrooms to create an affordable, comfortable teaching and learning environment in a hot climate. In the tropical climate of Malaysia, the school roof provides shelter from rain and sun but the walls follow the English-style of school construction designed for a cold climate. Without air conditioning, this style of architecture can create a worse comfort level than the outside conditions. The researcher assumed that to function well in a hot climate, classrooms mainly need a roof, an adequate floor and a perimeter buffer zone to the school site. This still leaves the potential interference (visual and noise) between classes unsolved. It is assumed that the design layout of the classrooms together with acoustic screens, earth forms and adequate distances between open classrooms, could reduce the internal noise interference to tolerable levels. In an open structure classroom the roof can remain uninsulated, therefore the most important structure, not just for shelter from rain and sun, can easily be designed to promote cross-ventilation as in traditional Malay buildings or 'rumah adat'. Security could be provided on the perimeter of the site by suitable fencing and outside interference could be minimised by visual perimeter buffer landscaping. For

valuable items, security might also be provided by means of lockable storage units within buildings or outside

2.0 Natural ventilation system

There is an increased tendency in eco-friendly design to utilise natural ventilation in place of or as well as full air-conditioning of buildings (Priolo.C, 1998, p.195). Ventilation systems, using only natural forces such as wind and thermal buoyancy need to be considered when designing the building, since the building itself and its components are the elements that can reduce or increase air movement as well as influence the air quality (dust, pollution, etc). The design guidelines and criteria for natural ventilation include recommendations and rules of thumb (Priolo. C et al, 1998, p.196) on:

2.1 Site design aspects regarding the location, orientation and layout of buildings as well as landscaping, for example choice of appropriate vegetation

2.2 Design programme aspects related to indoor air quality and ventilative cooling requirements

2.3 Building design aspects related to the building form, the vertical and plan distribution of spaces and the location and sizing of openings

2.4 Opening design aspects concerning the selection of the types of openings and screens as well as their operational features.

3.0 Building form and orientation

If a building is designed for an urban site, its location should be at a distance from other buildings that is greater than the depth of its wind shadow, so that the other buildings will not shelter it from winds. If this is not possible, the building should be positioned randomly with regard to the upwind buildings and with its longitudinal axis perpendicular to the prevalent wind direction in order to catch the streamline airflow. If the prevailing wind direction is different from the previous one in a different wind season, as is usually the case, it is possible to optimise the location of the building in order to obtain a good wind exposure, while sheltering the building. In very dense urban areas, spaces most needing ventilation should be put on the highest floors, where wind flow is stronger and less turbulent than near the ground (Priolo.C, 1998, p.197). This is particularly relevant when redesigning an existing school to incorporate outdoor classrooms. Architectural solutions, including for example the traditional wind catcher, can also be used to channel wind into buildings, even in built-up areas.

4.0 Landscape design

Besides facilitating wildlife refuges for birds, butterflies, insects and other fauna, landscape design has an important function in controlling the air movement around buildings for optimum natural ventilation. The type and layout of vegetation to be included in a site plan should be chosen with the airflow pattern in mind, as well as aesthetic and environmental considerations. The main functions of vegetation as far as air movement are concerned are:

4.1 sheltering from wind

4.2 wind deflection

4.3 funnelling and acceleration of air

4.4 air conditioning

Dense hedges of shrubs such as Bougainvillea, Hibiscus or Legerstroenia can be placed near a building to create positive and negative pressure zones, in order to enhance the airflow through the building. Hedges can be more cost effective and have a more pleasant appearance than blank walls or fences. When the placement of trees on a site is being

designed, their distance from buildings should be determined in relation to the context of the area. High-stem trees such as *Delonix Regia* (Flame of the forest), *Samanea Saman* (Rain trees), *Castonopsis inermis* (Berangan) with a large base canopy, would decrease the air velocity at canopy level, within a large area downstream, while letting through the air flow and accelerating it near the ground. This could affect the vertical displacement of the indoor airflow in relation to the position of the openings. Rows of trees and hedges can be placed to direct air towards or away from a building. Vegetation can create areas of higher wind velocities, by deflecting winds or funnelling air through a narrow passage. Reducing the spacing of the trees used to funnel air can increase the airflow up to 25% above that of the upwind velocity. A similar effect occurs at the side edge of a wind-break. Not only the air movement, but also the quality of air, is affected by vegetation. As air travels beneath canopies of vegetation, especially trees, it is conditioned with respect to both psychometric and environmental characteristics. Through the effects of shading and transpiration, the heat content of the ambient air crossing a vegetation barrier decreases, while the humidity of the air increases. This process induces an air-cooling effect. In addition, vegetation reduces noise, removes dust particles, absorbs carbon dioxide and introduces oxygen into air. By careful use of vegetation human comfort within the outdoor classroom can be greatly improved (Priolo.C, 1998, p.199).

5.0 Indicative measurements of human comfort levels - Post Occupancy Evaluation (POE)

Kuala Lumpur, the location of the pilot study, is situated at latitude 3° North, longitude 101° East and is near sea level. Consequently, the temperature is constant throughout the year. The monthly average of the maximum daily relative humidity is about 95%, and the monthly average of the minimum daily relative humidity is 60-65%. It rains almost every week throughout the year (source: Malaysian Weather Forecast Bureau, 1998, p. 10). The average monthly wind velocity in Kuala Lumpur is about 0.5 kmh throughout the year, except in July when it is 1 kmh. In the areas where the six schools are located there is wind caused by the 'heat island' phenomenon of Kuala Lumpur city. There are no typhoons or earthquakes. Preliminary POE pilot measurements suggest that outdoor classrooms could provide improved thermal comfort. In turn, this might provide an improved teaching and learning environment. Figure 1 supports this, showing measurements of student and teacher preferences for learning outdoors. On a scale of 1-5, five out of six students in schools surveyed - said that they were interested in the idea of outdoor classrooms. The remaining school students did not agree, possibly due to the physical limitations on-site, such as lack of space in school grounds as a result of being located in the city centre. The measurement of teacher opinion gives a 50% preference for teaching in an outdoor classroom.

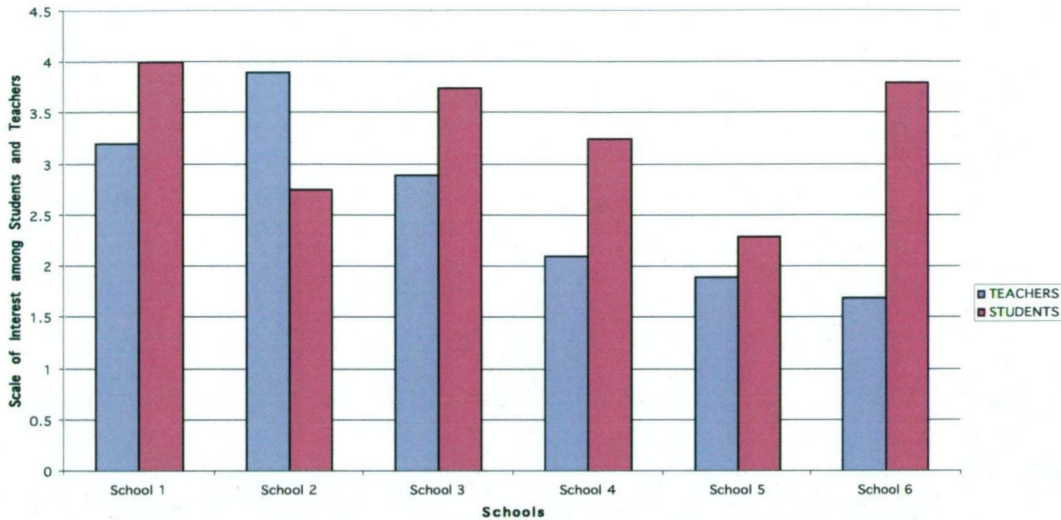


Figure 1 - Measurement of student/ teacher preferences for outdoor learning at 6 schools in urban Kuala Lumpur.

Figure 2 shows pilot comfort measurements surveyed among students and teachers in six schools in an urban area in Kuala Lumpur, Malaysia. The measurement of the thermal environment in the six schools was carried out on 30 June 2001, using wet and dry thermometers with built-in memory. The three different spots for measurements were taken in the classrooms, on an open-air tarmac area in the school grounds and under a dense vegetated shady area in 6 schools grounds.

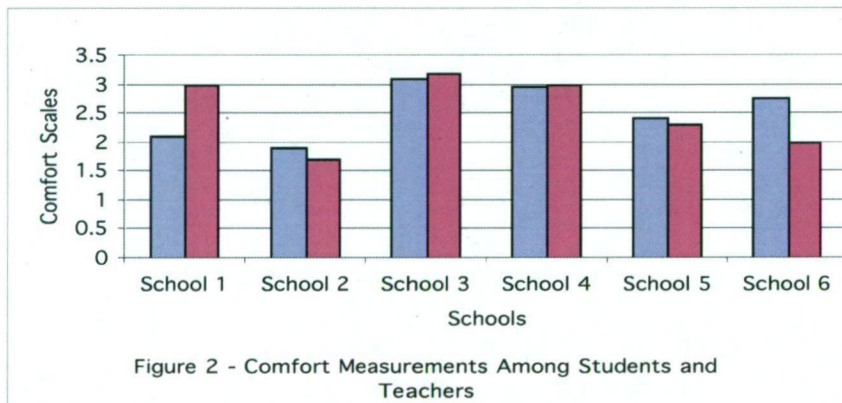
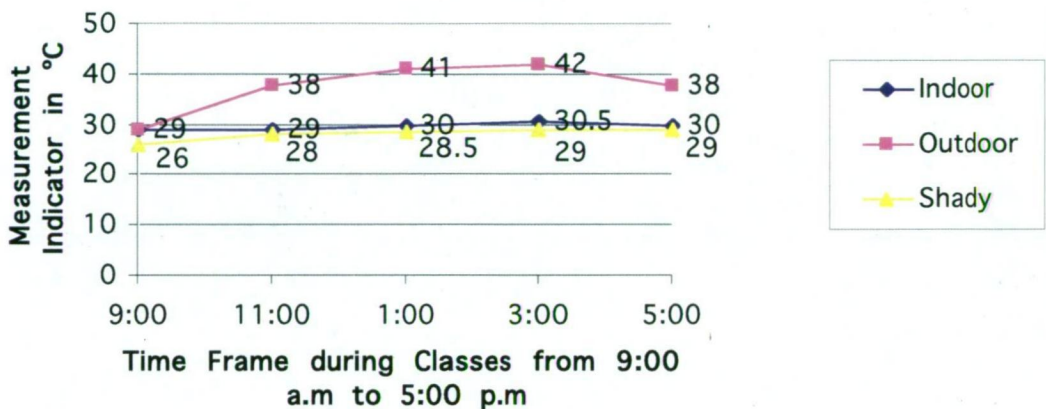


Figure 2 - Comfort Measurements Among Students and Teachers

Since the temperatures are quite consistent throughout the year, measurements were taken for one day only. To ensure comparability of the results, the measurements were taken at the same time of day for all six schools. Results indicate that on a scale of 1-5, measurement of student and teacher opinions in 6 schools concerning comfort level, show that they exceed 2.5 in 4 schools. In School 6, teachers' perception of comfort levels was greater than of students, possibly due to the controlled temperature environment in the classroom. In this example students were cold sometimes, because they were stationary at their desks, whereas the teacher was more active. Figure 3.1 show the typical results of further investigations of temperature measurement in the six schools. They indicate that none of the average classroom temperature readings were in the comfort zone of 25° C-27.5° C (determined using; DA Sketch Pad).

Figure 3.1 - POE on Comfort Zone (25°C-27.5°C) during Classes in School

1



Based on Figure 3.1 (measurements at two-hourly intervals from 9:00 a.m to 5:00 p.m) the comfort zone was achieved only within the shady areas in School 2. None of the classrooms in the 6 schools currently enjoy an adequate comfort zone during classes, either in the morning session (7:45 am – 12:45 am) or the afternoon session (1:00 p.m – 5:00 p.m). In Schools 4 and 6, the shady area was in the comfort zone from 9:00 a.m – 11:00 a.m on the day the measurements were made.

6.0 Possible economic benefits

Preliminary comparisons suggest that outdoor classrooms are considerably cheaper to build than traditional classrooms. This analysis is based on a prototype study model from a standard government funded primary school in Malaysia, which has a minimum number of 24 standard classrooms. This excludes special classrooms such as labs and computer rooms. Substituting outdoor classrooms might save approximately RM 35,000 (AUD 17,500) for each normal classroom, (refer figure 4). The lower maintenance costs for outdoor classrooms, which do not need painting or floor coverings, would further reduce costs over the lifetime of the building. It is estimated that in a standard 24 classrooms school the total construction saving could be in the range of RM 420,000 (AUD 210,000) if half of the standard classroom are substituted by the light weight and open classroom.

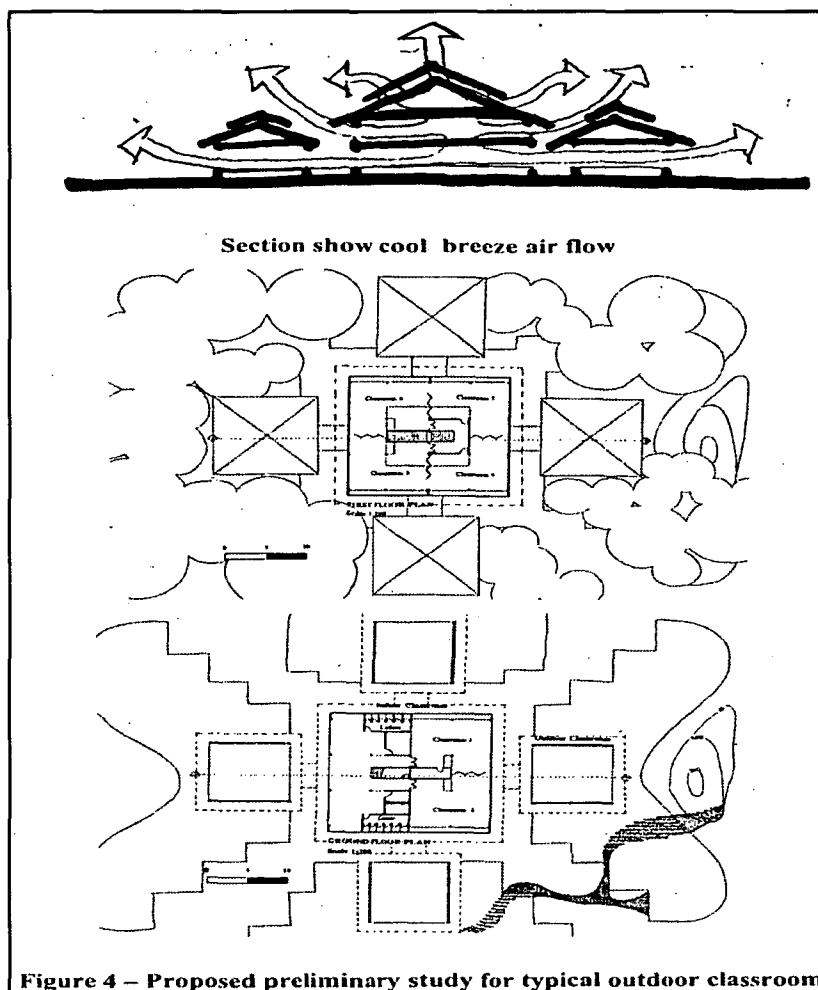


Figure 4 – Proposed preliminary study for typical outdoor classroom

7.0 Possible curriculum benefits

The study of ecology in the well-planted school grounds could produce educational benefits while contributing to climate control. The results of a preliminary questionnaire, involving 300 students, 30 teachers and 6 schools - the potential end users of the research, identified subjects from the 10 subjects areas approved by the curriculum board in the Malaysian Ministry of Education, that could be taught and learnt outdoors. They are languages, maths, geography, history, science, religious studies, life skills, arts and drama, music and physical education

8.0 Conclusion

The initial research shows initial positive indications for the implementation of outdoor classrooms in tropical countries. The pilot POE study on comfort measurements for schools shows that there is an opportunity to achieve improved comfort conditions for teachers and students during lessons. In the tropical climate of Kuala Lumpur the implementation of shaded but open walled classrooms appears to be a both economically and environmentally attractive solution alongside the potential human comfort benefits. The study model developed is based on existing standardised government and private primary schools. It shows how cross-ventilation and the stack effect can be produced by raising and opening the two tier roof for indoor classrooms (labs, workshops, computer rooms) with facilities for storage, toilets and adjustable classrooms able to be transformed into a bigger classroom space whenever the need arises.

Based on the costing of a covered walkway as a shelter with concrete roof tiles for the outdoor classrooms, an amount of RM 35,000.00 x 12 classrooms (as a prototype for an adjustable classroom) would save RM 420,000 (AUD 210,000), for each primary school complex. This represents a saving of approximately 80% for each outdoor classroom compared to the normal indoor classroom cost. Further cost reductions can be achieved by using cheaper roofing materials such as metal decking and native building materials such as bamboo for blinds and wall panels and dried coconut leaves as roofing and wall panels. Operating costs for the school could also be reduced by using solar power and alternative construction methods such as free-fall pitch roofing without the use of gutters and rainwater collection in wildlife ponds. Conservation of existing vegetation and the addition of new vegetation would contribute to the comfort of students and staff as well as being a useful addition to the school curriculum and ecology of the site. Further research will establish methods for achieving the optimum use of outdoor classrooms together with the specific and detailed analysis of the proposal.

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